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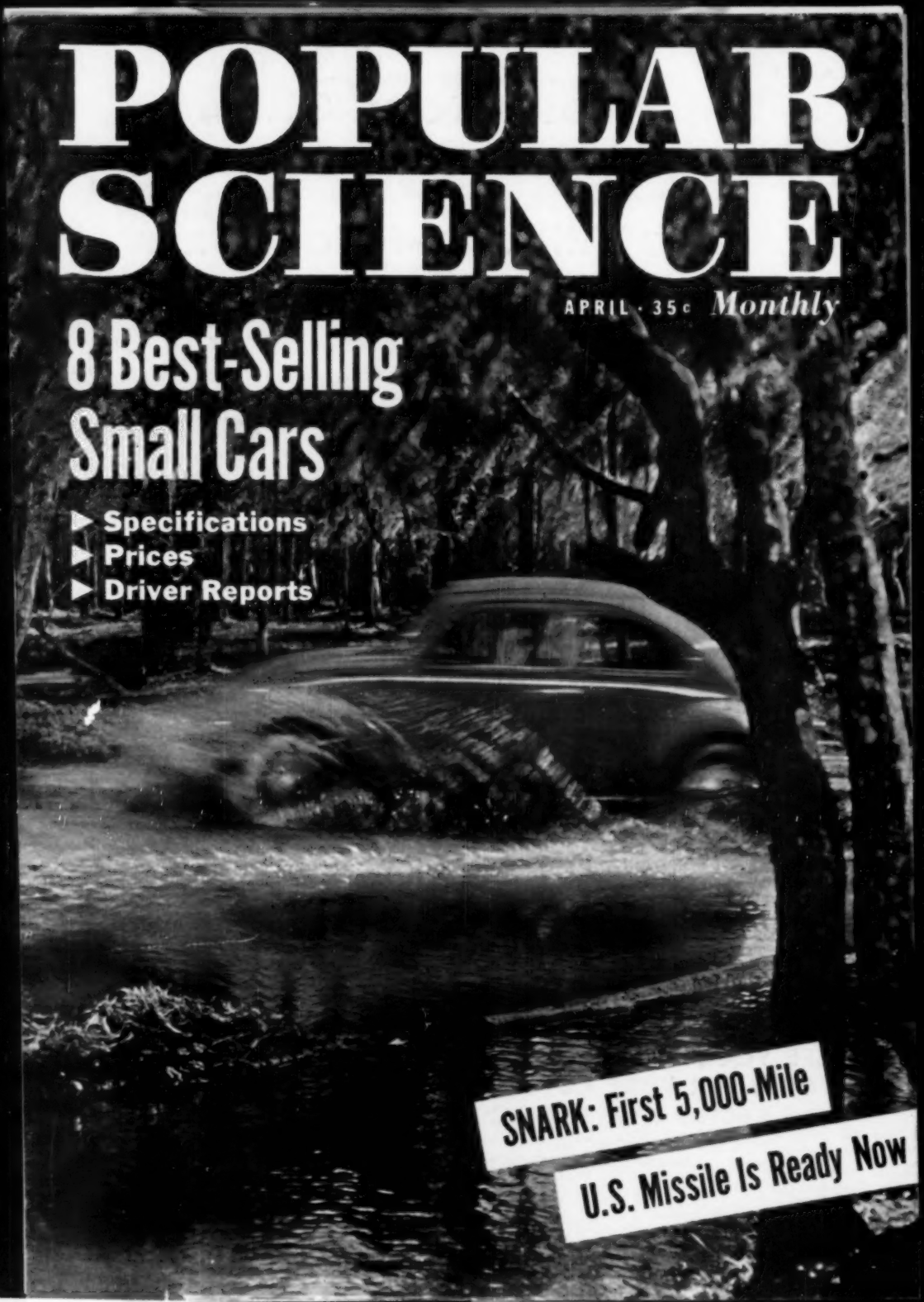

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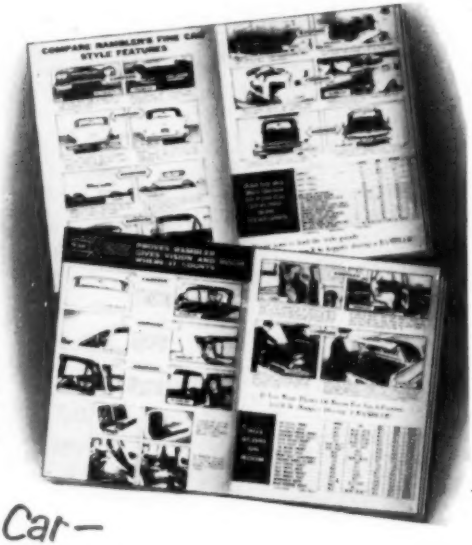

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Popular Science Monthly

April, 1958

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While scientists try to develop more elaborate missiles, here's the U.S.'s bird-in-hand: the deadly, pinpoint-accurate Snark

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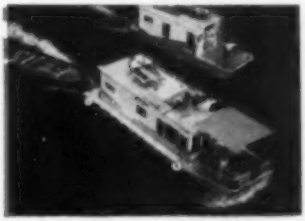

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PS Readers

TALK BACK

Car Owners Sound Off About Poll

DETROIT says they do make a plain-Jane car almost stripped of chrome and trim ["Are They Building the Car You Really Want?" Jan.], and hardly anybody buys it. What do they expect?

They fail to mention that the car is also stripped of radio, heater, V-8 engine, and other things that most people want, but have to buy the chrome to get.

Consider the popularity of "custom" cars, many of which are stock jobs stripped of chrome and repainted. They look smoother and cleaner, and yet retain the more useful features of deluxe cars.

MICHAEL TUFFLEY, FT/3, FPO, NYC

. . . With regard to car size, what I want is something that will fit in my 20-year-old garage. Today's Chevrolet won't. My '32, '33 and '37 straight-eight Hudsons made it easily, yet they had ample interior room. If Chrysler "nearly lost its shirt" trying to move a small car, my answer is that conservative design was the only good feature of the car. No one in Detroit has ever built a really good reasonably sized auto, although some European luxury cars show that it can be done.

A. P. STEENSEN, Sharon, Mass.

. . . I'm beginning to believe that polls somehow miss a large and growing segment of car owners: people who keep what

they have because Detroit isn't building cars that please them.

W. B. HOWARD, Wilmington, N. C.

Girls, Boys and Delinquency

"WHY Girls Are So Good" [Jan.] carried a lot of food for thought. Has anyone ever stopped to consider how much the automobile has contributed to juvenile delinquency?

Without a car, a juvenile couldn't do so much aimless running around in search of excitement, couldn't go so far from home, couldn't get away so fast when he does something wrong. The automobile has become an unsupervised clubroom for gangs and an unchaperoned lounge on wheels.

DON HILL, Los Angeles

. . . To compare the actions of the sexes, you must first compare the inherent drives that lead to these actions. There is a vast difference in the drives of each sex and I wouldn't alter this, even if it could be done. I'm just old-fashioned enough to like the idea of two sexes. Your article failed to mention:

1. That our legal system is based on the idea that the object of laws is to control men.

2. That a first responsibility of each male is the control of women.

3. That our failure to teach youth to accept this responsibility is probably the cause of 80 percent of our crime.

What we need is a vigorous campaign to teach our youth their responsibilities and how best to manage them.

J. R. HARPER, Keego Harbor, Mich.

Russian Tour Draws Bouquet and Frown

EDITOR Walton's open mind, demonstrated in his piece on Russian technology [Jan.], is something the world needs very badly.

Not so long ago, another American magazine reported on Russian fashions, telling how dull and dowdy the clothing is. There was no apparent understanding that the Russians are different people with different needs and a different economic stress than ours.

Harry Walton seems to feel no need to judge; rather, he reports on what is available to Russians and how it fills

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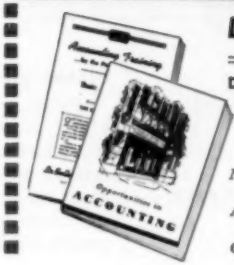

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their needs. To him, the Russian is a human being—certainly a refreshing point of view.

G. H. CARDOZO, Greens Farms, Conn.

. . . It was a pleasure to be with Harry Walton on our trip through Russia, and the picture story in February POPULAR SCIENCE ["Inside Russia by Car"] was a delight to my family and friends. But the lack of picture credits has kept me busy explaining which photographs I took and which he did.

DENNIS M. O'CONNOR, Maplewood, N. J.

Sorry. O'Connor snapped those on pages 94-95, the three big ones on 96-97, and the three small ones on page 98. Walton also points out that, though he set up the cover picture, it was O'Connor who deftly snapped it, with Walton in the car.

A GI Says It Isn't So

YOUR chance of learning a trade in military service [Jan.] is the bunk. I've been in the Air Force since 1954 and not a tenth of the men I know are working at a trade they know, or learning one.

Why don't you tell parents about the Air Police who guard aircraft, or the GIs

who pull KP—and nothing but KP—for four years? What trade are they learning?

Military needs come first and if you are not in the right place at the right time, you can kiss good-bye that trade you hoped to learn.

Name withheld
U. S. Air Force

Plutocrats of the Open Road?

THAT picture of a Kenworth truck [Dec., p. 250] made me wonder why you don't run more on trucks. Thousands of drivers ride sleeper rigs and many read your magazine. Maybe you don't know the modern truck driver. He is not the uneducated, rough, tough, homeless tramp

of a few years back. Most of the large

How we retired in 15 years with $300 a month

"Here we are, living in Southern California. We've a little house just a few minutes' walk from the beach, with flowers and sunshine all year. For, you see, I've retired. We're getting a check for $300 a month that will keep us financially independent as long as we live.

"But if it *weren't* for that $300, we'd still be living in Forest Hills, and I'd still be working. Strangely, it's thanks to something that happened, by chance, in 1941. It was August 17, my fortieth birthday.

"To celebrate, Peg and I were going out to the movies. While she went upstairs to dress, I picked up a magazine and leafed through it idly. Then somehow my eyes rested on an ad. It said, 'You don't have to be rich to retire.' And just that evening Peg and I had been saying how hard it was for us to put anything aside for our future.

"Well, we'd certainly never been rich. We spent money as fast as it came in. And here I was forty already. Half my working years were gone. Someday I might not be able to go on working so hard. What then?

"This ad told of a way that a man of 40—with no big bank account, but just fifteen or twenty good earning years ahead—could get a guaranteed income of $300 a month. It was called the Phoenix Mutual Retirement Income Plan. No harm in looking into it, I thought. When Peg came down, I was tearing a corner off the page. First coupon in my life I had ever clipped. I mailed it on our way to the movies that night.

"Fifteen years slide by mighty fast. Times changed . . . hard times came . . . the war. I couldn't foresee them. But my Phoenix Mutual Plan was one thing I never had to worry about! 1956 came . . . I got my first Phoenix Mutual check—and *retired!* We sold the house and drove west. It's a new kind of life. Best of all, we've security a rich family might envy. Our $300 a month will keep coming as long as we live."

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This story is typical. Assuming you start at a young enough age, you can plan to have an income of $20 a month to $3,600 a year or more—beginning at age 55, 60, 65 or older. Send the coupon and receive, by mail and without charge, a booklet which tells about the Phoenix Mutual Plans. Similar plans are available for women. Don't delay. Send for your copy now.

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CTI sends you a Tune-Up Kit, the kind that skilled mechanics use to locate engine troubles. You receive a compression Tester; Vacuum Gauge & Fuel Pump Tester; Ignition Timing Light; portable steel case. You also get mechanic's tools, including socket set. You acquire *experience* using kits.

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is yours at no extra cost. Only CTI offers this *extra* choice. You get fully-rounded training in all phases of mechanics.

Many Students Earn Money as They Train

by taking part-time jobs in local shops or fixing cars "on their own." Many make enough to pay all tuition and buy extra equipment. Some open shops, become independent.

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Name_____ Age_____

Address_____

City_____ Zone____ State_____

of a few years back. Most of the large companies give aptitude tests that call for a high-school education and a high IQ. The average pay for a sleeper driver may go as high as $1,000 per month. Most of these men are married and own their own homes. They have quite a knack with tools and like your articles.

The Cummins diesel is the most popular engine in the big rigs. They have a new water-cooled turbo-supercharger powered by exhaust gas. I drive a 60-foot Peter-built tanker with a 200-horse Cummins engine. It is a sleeper rig. We haul 8,600 gallons of gasoline.

M. M. PARSONS, Salt Lake City

Age Creeping Up on Gus?

JUST read your January issue and find myself slightly confused.

Gus says [p. 238] if a gas station puts antifreeze in an air hose to prevent icing, "there's a possibility of getting alcohol fumes in tires. Spark a charge of static electricity in them—and boom!"

William Carroll [p.122] says the extra windshield-washer bottle on Chevrolet air-suspension cars "holds anti-icing alcohol for the air compressor."

If Gus is right, then look out! The "Hot One" will be hotter—0 to 60 m.p.h. in two seconds, straight up!

J. ZAJACKOWSKI, Philadelphia

Sioux City's Sioux Saw

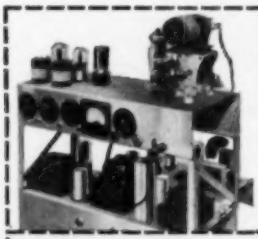
THAT was a fine article on power saws in your January issue ["How to Choose a Portable Saw"].There were one or two saws there I never heard of. Then there's one I have heard of but, apparently, you haven't.

The name is SIOUX. It's manufactured by Albertson & Co., Sioux City, Iowa.

C. W. STEVENSON, Minneapolis

Sixth PS Award Brings Applause

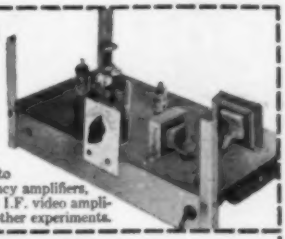
IT HAS just come to my attention that POPULAR SCIENCE has won the special merit award of the National Safety Council for the sixth consecutive year. For such continuous outstanding performance in the field of safety on the highways, the



YOU BUILD Broadcasting Transmitter

As part of N.R.I. Communications Course you build this low power Transmitter; use it to learn methods required of commercial broadcasting operators, train for FCC license.

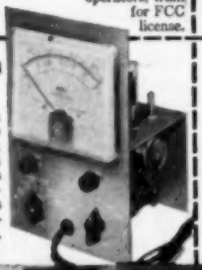
YOU BUILD Signal Generator



N.R.I. sends kits of parts to build this Signal Generator. You get practical experience, conduct tests to compensate Radio frequency amplifiers, practice aligning a typical I.F. video amplifier in TV circuit, many other experiments.

YOU BUILD Vacuum Tube Voltmeter

Use it to get practical experience, earn extra cash fixing neighbors' sets in spare time, gain knowledge to help you work in Radio, Television, Color TV. With N.R.I. training you work on circuits common to both Radio and TV. Equipment you build "brings to life" things you learn in N.R.I.'s easy-to-understand lessons. 64 page Catalog FREE, shows all equipment you get.



YOU BUILD AC-DC Superhet Receiver

N.R.I. servicing training supplies all parts, everything is yours to keep. Nothing takes the place of practical experience. You get actual servicing experience by practicing with this modern receiver; you learn-by-doing.

Learn RADIO TELEVISION

by Practicing at Home

WHAT GRADUATES DO AND SAY

Chief Engineer

"I am Chief Engineer of Station KGCU in Mandan, N. D. I also have my own spare time business servicing high frequency two-way communications systems." R. BARNETT, Bismarck, North Dakota.

Paid for Instruments

"I am doing very well in spare time TV and Radio. Sometimes have three TV jobs waiting and also fix car Radios for garages. I paid for instruments out of earnings." G. F. SEAMAN, New York, N. Y.

Has Own TV Business

"We have an appliance store with our Radio and TV servicing, and get TV repairs. During my Army service, NRI training helped get me a top rated job." W. M. WEIDNER, Fairfax, South Dakota.

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Today's OPPORTUNITY field is Radio-Television. Over 125 million home Radios plus 30 million sets in cars and 40,000,000 Television sets mean big money for trained Radio-TV Technicians. More than 4,000 Radio and TV Broadcasting stations offer interesting and important positions for technicians, operators. Color television, portable TV sets, Hi-Fi, other developments assure future growth.

It's the trained man who gets ahead. The fellow who uses his spare time to develop knowledge and skill gets the better job, drives a better car, lives in a better home, is respected for what he knows and can do. So plan now to get into Radio-TV.

Keep your job while training with N.R.I. You learn at home in your spare time. N.R.I. is oldest and largest home study Radio-TV School. Our methods have proved successful for more than 40 years, provide practical experience.

Soon after enrolling, many N.R.I. students start to earn $10, $15 a week extra in spare time fixing sets. Many open their own full time Radio-TV shops after getting N.R.I. Diploma. Find out more. Mail Coupon. Cost is low, terms easy; includes all equipment. Address: **National Radio Institute, Dept. 8DB, Washington 16, D.C.**

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RALPH H. JAMES, Ex. Dir.,
IGO-A, Inc., Tulsa

Correspondence School Speaks Up

"PLAIN Facts About Correspondence Schools" [Feb.] was interesting and well done. But there is an inaccuracy concerning Alexander Hamilton Institute which I think you would like to have cleared up.

With each of the 26 texts of our Modern Business course, we send the student a problem he is supposed to study. He then returns his solution to us, we constructively criticize it and grade it, and return it with a Model Solution for comparison with his own. Thereafter, he is free to enter a defense of his viewpoint or ask for further information or clarification on any point.

M. B. FOSTER, Pres.
Alexander Hamilton Institute, NYC

. . . I took a course by mail (carpentry foreman) about four years ago and I got took—most of it dealt with practices 25 years old or more. I learned nothing but where wood comes from.

There was nothing about new types of windows such as sliders and jalousies. There was nothing on sheathing exterior walls while still laying on the deck, or putting cornice on while walls are flat; and FHA and VA minimums for building were ignored. I am now a carpenter foreman and layout man, but all my knowledge came from building-specification books and trade journals, plus actual work in the trade. These schools may be okay on electronics, but they need to update many other courses. The building trade is nothing to tackle 1910 style.

WALTER MARTYNOW, Livonia, Mich.

Dye Locates Transmission Leak

IN DISCUSSING the automatic transmission in "How to Hunt Down an Oil Leak" [Jan.], you mention the difficulty of determining where a leak is coming from: transmission or engine. As an auto repairman, I can suggest a simple test:

Mix one tablespoon of dye (we use a DuPont red organic dye) in a minimum of one quart of oil drained from the engine. Pour it back and red seepage will signal a leak in the engine.

C. L. ZIEBARTH, Winsted, Minn.

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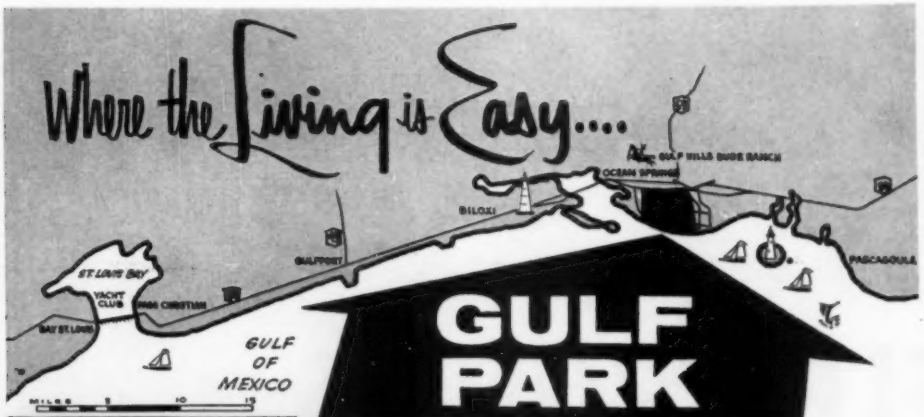

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Above less 10% discount with $100 down, $8 per month, 15% discount for cash payment in full.

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Located on the Mississippi Gulf Coast where white beaches extend 60 miles. Bays, Bayous, Rivers, offer fresh and salt water fishing, every water sport, in Gulf Park Estates; golf, riding, hunting, nearby. Entrance: 3 miles East of Ocean Springs on Old Highway 90, just across the Bay from Biloxi.

Ideal Climate Year-'Round

Gulf Park Estates offers ideal climate you'll find anywhere with annual average temperatures ranging from 67 to 71 degrees. The summers are comfortably cool and the winters are mild, unlike most neighboring areas where it gets stiflingly hot. This community grows citrus fruits, vegetables, abundantly. In winter there is seldom a chilly day, practically no frost. Ideal climate for asthma, sinus and arthritis.

Planned community—
Every Homesite on Paved Road

Gulf Park Estates will reserve space for Shopping Centers, Parks, Churches, Schools, and Yacht and Country Club with boat harbor for all property owners. Some roads are already paved and a guarantee goes with each purchase that the fronting street will be paved or a suitable exchange made. Electricity and telephone lines are already in. Bottled gas is available until nearby natural gas can be piped in. Natural gas is nearby and undoubtedly will be available in the property soon. All property owners have privilege of entire beach and inland boat harbor. Elevation is 5 to 20 ft. Guaranteed all high and dry.

Many beautiful homes now exist in the Gulf Park Estates area. Artesian water is available to each homesite. You'll enjoy meeting thousands of people who come here yearly, either for a vacation or for permanent residence. Living is at its best on the Mississippi Gulf Coast. The people are friendly and neighborly; and living is economical.

1,000 MILES NEARER YOUR HOME

The Mississippi Gulf Coast is 1,000 miles nearer than most midwestern areas where many communities similar to Gulf Park Estates are now being developed. You save at least 2 days driving time. Start Planning Your Future Today! Send $8 Deposit.

Completely Descriptive Literature!

Send us $8 deposit on your homesite today and we will mail you plat and map showing location and abundant descriptive literature about the Mississippi Gulf Coast and Gulf Park Estates; also, actual photo of your lot for approval. Your money will be returned if you decide not to buy within ninety days.

PRICES INCLUDE:

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We make it easy for you to move on your property.
Restrictions: $10,000 Homes, or 1,000 sq. ft. main floor space, 400 acres reserved for $3,000 homes and trailers.
For reference, contact Peoples Bank, Biloxi, Mississippi.

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Orders from this ad will be assigned corner lots as long as available.
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We confidently predict that the $895 Gulf Park Estates Homesites will be going at nearer $5,000 within 2 years. Our lots have already advanced $200 within the last 30 days. We expect to sell 75% of the 10,000 lots in the next 12 months. Invest small amount now and reap big profits tomorrow. You may come choose your lots personally, if you wish, or you may trade or exchange your lots at any time for any other lots available at prevailing printed prices. Buy now. Get on the ground floor. The state of Mississippi has a $5,000 tax exemption on homes. Taxes are a low 66 mills in Gulf Park Estates.
You may choose your own contractor; however we will assist you on request. Build or sell any time you wish.

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Pink House, West Beach, Biloxi, Miss.

Reserve for me ..... homesites. Enclosed is ..... deposit or full payment on each homesite. Send contract and map showing location. It is understood that my deposit (or cash payment) will be returned without question if I request it within 90 days.

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The month in science

Shoot for space. Sophisticated scale-ups of the good old Fourth-of-July skyrocket look better and better for the ride into space. The experts are turning back toward solid, gunpowder-type fuels, the kind first used in rocketry but more recently limited to small (comparatively speaking) missiles. One sign: successive speed-ups in work on Navy's solid-fuel, submarine-launched Polaris.

- Big rockets now use liquid propellants: an oxidizer (LOX, fuming nitric acid) and a fuel (gasoline, liquid hydrazine). These are pumped from separate tanks to a combustion chamber where they mix and burn to create the gases that drive the rocket up.
- It's complicated. You need pumps, valves, other intricate equipment. Worse, this all has to be checked out, and fuel tanks loaded, just before firing in a torturous countdown. One Vanguard countdown ran four days before it was abandoned.
- Solid-fuel rockets are simpler. They come ready to fire, with propellant factory-loaded inside their combustion chambers.
- Typical propellants: cellulose nitrate plasticized with glycerol trinitrate (that's smokeless powder), ammonium perchlorate mixed in resinous fuel. These are cast in place while still liquid, or made into pellets and then packed into the rocket.

A major factor in the swing toward solid fuels: the Army-Navy sprint for second in the big satellite race.

Navy's Vanguard has two liquid engines, one solid. Three launching flops involved the liquid stages.

Army's Jupiter C, which did put a Made-in-U.S.A. moon up, has one liquid stage (a modified Redstone missile), three solid stages (scaled-down Sergeant missiles—a cluster of 11 for stage 2, five for stage 3, one for the now-orbiting stage 4).

Another factor: Much bigger and more powerful solid-fuel rockets can be made today. Some boron compounds, which make super fuels for liquid-powered rockets, are solid materials, could be used in solid rockets.

Lockheed's X-17 research missile is a sample of what can be done. It is 40 feet overall, has three stages (all solid fuel), is reported to have flown 4,000 miles high. According to rocketman H. W. Ritchey, addition of a fourth stage would make it a good satellite launcher (15- to 20-pound payload).

Don't understimate the power of the liquids, though. By the time solid propellants are ready for space ships, liquid engines will be improved, too. Very complicated machinery can attain high reliability (one example: the modern auto engine).

But right now solid fuels are riding high.

Look, no wheels. Ford's engineering-research vp. Andrew A. Kucher unveiled a pet project late last month: a vehicle without undercarriage or suspension that glides, almost friction-free, on a film of compressed air (like air-supported parts of gyros). Kucher sees the Leva-Car sliding interurban passengers at 350 m.p.h.

over rails, not roads. A turbojet would push it, also compress air to hold it up. So far, there's only a model.

How big is an inch? Well, which inch? Machine-tool makers, who care very much, are bedeviled by three kinds of inches (U.S., British and Canadian), all different (a political problem) and all distressingly fuzzy (a scientific problem). Help is in sight.

First: a sharper inch. Precision instruments are now demanding .00001-inch tolerances. That's for production *parts*. Production-line *gauges* need smaller tolerances, master gauges still smaller.

The machine-tool men would like master gauges good to .0000001 (that compares to human-hair thickness as a foot to a mile). National Bureau of Standards, which is Official Keeper of the Inch, can't deliver such accuracy yet. Reason: The master of all masters—the platinum-iridium meter bar locked in a vault in Paris—cannot be measured close enough.

What's needed is a new primary standard. NBS Director Allen V. Astin predicts international agreement (by 1960) on an atomic measuring stick: the wave length of orange light emitted by one particular kind of krypton atom (krypton is a gas used in "neon" signs). This is measurable to such accuracy that .0000001-inch master gauges could be made.

The political problem is tougher. The three inches differ by less than .00001 inch, yet that is enough to create trouble when instruments (or parts) made in different countries must be used together.

- Present British inch is 2.5399956 centimeters. But a proposed switch to a new official yard would make the inch exactly 2.54 cm.
- The Canadian inch is already 2.54 cm. Australia now has no legal standard but leans to the 2.54-cm. inch also.
- The U.S. inch is 2.540005 cm. (Oddly, it's not really official because Congress has never specified a legal standard inch.)

Machine-tool makers want the U.S. to adopt the 2.54-cm. inch, too. Not only would this put us in line with other English-speaking countries, but it would also make our machines usable with the metric system (a simple gear of 127 or 254 teeth converts measurements automatically).

Why not go ahead? Maps. The Coast & Geodetic Survey has laid out 150,000 markers by the present inch. A change would tangle boundaries across the country. That minute .000005-inch shift would be multiplied to shift some lines three or four feet.

Diplomatically, Dr. Astin last winter suggested a way out: international agreement—without specific legal blessing—on a yard that would give the 2.54-cm. inch. Map men could continue with their unofficially-official orphan inch, machine men would get their world-wide, easily converted inch. Everybody should win.

Martin Mann

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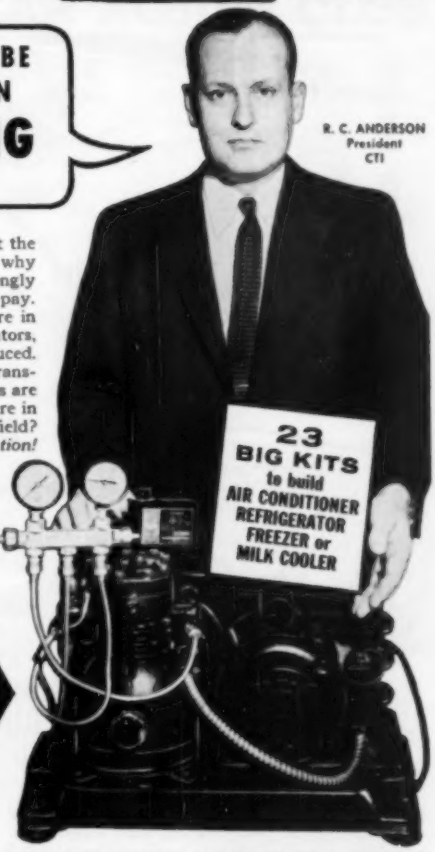
AIR CONDITIONING

AND REFRIGERATION



R. C. ANDERSON
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It has been one of America's great industries for years—but the way it's growing, you'd think it was in its infancy! That's why the air conditioning and refrigeration industry appeals so strongly to ambitious men who want better jobs, more security, higher pay.

Over 150 million refrigerating units are in use today—are in need of repair and service. Each year, 3 million refrigerators, 1 million freezers and 2 million air conditioners are produced. Not only homes, but stores, offices, restaurants, motels and transportation systems use some form of refrigeration. Even autos are being made with air conditioners. No wonder trained men are in big demand—are so well paid! Want to be a mechanic in this field? To find out how, *just mail coupon for valuable free information!*

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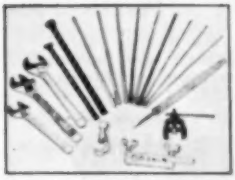
After years of research, CTI has developed a wonderfully effective training plan. It enables you to train at home in spare time. *You get 23 big kits* to build an air conditioner, refrigerator, freezer or milk cooler. You keep all this equipment. *You do 10 service and trouble-shooting jobs.* CTI brings field training right into your home! You get practical experience as you learn.

YOU GET EXPERIENCE AS YOU TRAIN BECAUSE YOU PRACTICE WITH COMMERCIAL EQUIPMENT

You get all parts and tools to build a heavy-duty, commercial-type, ¼ h.p. refrigeration high-side (illustrated at right.) You receive lesson material which not only makes kit assembly *easy*, but downright *fascinating!* Remember, kit training in this field is a CTI "FIRST"



Above left is photo of special tools in just one kit. In another kit (right) you get motor, fan, pulley, service tools. You get other tools, tubing, much equipment, all of finest quality. Kits are sent on a planned schedule so that you learn in easy stages. Kit training develops skill, provides experience, speeds training.

HOW YOU MAY EARN CASH AS YOU TRAIN

Many students do repairing in their spare time soon after they enroll. A number get part-time jobs, others open shops. With their earnings many students not only pay their tuition, but sometimes have enough money remaining to put in the bank. The reason that students can do field work for profit is that CTI training is *practical*. Students get their experience as they *train*—not as low-paid apprentices! But get the complete story on your opportunities. *Fill out and mail coupon today.*

OPEN A SHOP—BE THE BOSS

The air conditioning and refrigeration industry is a good one in which to start out "on your own." Many CTI graduates have done it, and if you have the determination, you could do it, too! CTI has special information for men who want to go into business. *Mail coupon for details.*

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City_____ Zone____ State____

Keeping the Home Shipshape

STRIKE WOODEN MATCHES handily on a strip of sandpaper taped near the kitchen stove. Just fasten it in place with masking tape and it can be replaced easily with a new strip.

A WIRE TIE RACK from the dime store will keep an umbrella from slipping to the floor of a closet. Mount it so that it folds downward to hold the standing umbrella against the wall.

KITCHEN CHAIRS CAN'T SCRATCH paint, tile or wallpaper if you protect them with wall bumpers. With wooden chairs, insert rubber-headed tacks or toilet-seat bumpers in the back rests to soften the jar when they are pushed against the wall. To cushion the back of a tubular metal chair, cement weatherstripping to the section that touches the wall.

VENETIAN-BLIND CORDS CONFUSE YOU? Wrap one cord on each blind with a bit of colored tape. Then a glance will tell you which cord to pull to tilt the slats the way you want them.

HIDING A KEY to the back door is easy. Cut a small slot in the frame of the screen door where it fits against the jamb. Drive in a finishing nail and hang the key in the slot.

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THESE FIVE OR ANY FIVE OF THE 24 ALBUMS LISTED BELOW FOR ONLY $3.98 [RETAIL VALUE AS HIGH AS $24.90]

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Two-Tone Dinner Gong. Only the sounds are different when you strike the two brass disks of this mated dinner-gong set. Designed and made by Claire H. Andrews, a retired school superintendent in Marion, Iowa, the project displays fine wood- and metalwork.

The frames and cork-headed mallets were cut and turned from native cherry. Decorative hammering tensioned the disks to the desired resonances. They are suspended with nylon cords.

Playhouse in the Sky. It's been high life for seven-year-old Christine Neumann since her father, Alfred, built this aerial playhouse in the back yard of their Spring Lake, Mich., home. A swing set does double duty as part of the supporting framework for the house and sun porch. Canvas roof and hardboard walls are easily removed for winter storage and painting.

Have *you* recently completed a workshop project of which you are particularly proud? Send a good photograph of your work, along with the negative and a brief description, to the Mechanics and Handicraft Editor, POPULAR SCIENCE, 353 Fourth Ave., New York 10, N. Y. We will pay $15 for each item that is accepted for publication.

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE readers. What's *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

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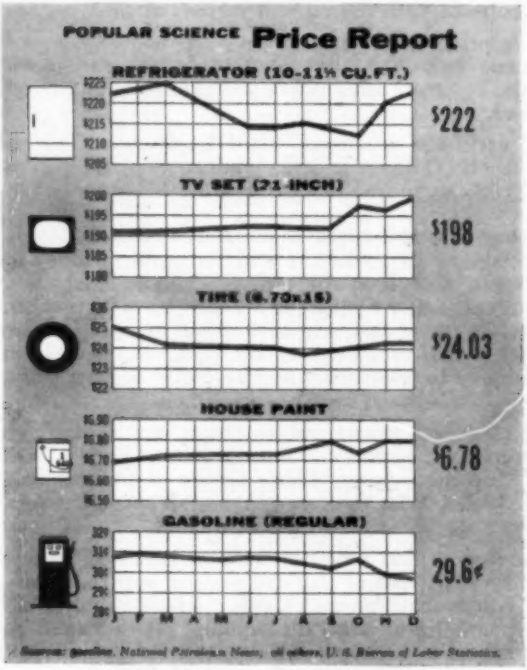
You ought to know...

Now is still a good time to shop around. Prices seem to be leveling off. All five commodities in the Popular Science Price Report have held steady. Your local shopping center is a buyer's market. There are some good but not dirt-cheap bargains to be had.

Closely related to the prices in the PS chart is the Consumer Price Index, published by the Bureau of Labor Statistics and covering all the major items that go to make up your whole cost of living. Last December, the index made front-page news: For the second month running, it stayed unchanged after a steady climb up through the previous 16 months. It rose over 19 percent from its 1950 low, and leveled out to 121.6. You, as a consumer, kept the index from going higher. Actually, you made the news.



U.S. buyers got tough, and showed a resistance to the new car prices. They had jumped nearly 12 percent over the dealers' prices for the previous, old-model month. You wouldn't buy. That forced dealers to cut their prices. The discounts they gave evened out to about 2.5 percent. It was enough to hold the index steady.

- These prices should go down: Clothing prices have slipped, starting the first of the year. And store owners may cut them more, to get their racks cleared for spring and summer apparel. Gasoline has slipped on the PS Price Report. The summer demand, though, can keep it from slipping more. Tires are a possible sleeper. Auto production is off, remember. So a build-up in tire inventories could push down prices. That last tank of fuel oil for your furnace may be a good buy. Demand, slower than expected last winter, left big inventories.
- These prices should hold steady: Exterior house paint has straightened out on the price curve. But it's sometimes touchy to seasonal demands. Buy before July at the latest. Now that

You ought to know...

new models have lost their luster, refrigerator prices should settle down. There's a chance that they will even go into a slight slump this spring, repeating last year's downtrend.

- These prices will probably rise: Viewing a new television set will cost you more. Prices have climbed steadily. Day-to-day living costs more, too. A meat scarcity has caused higher prices. Farmers are holding stock back from market, building up their drought-ridden herds with the current surplus of feed.

The forecast is pretty clear: The grocer's bill will total a little more. The same holds for services: doctor's bill, garage mechanic's repairs. But most other prices will probably hold steady through summer.

Don't put off appliance purchases, house improvements or car fixings much beyond October 1. Signs point to a business pickup by then. And you can be sure that prices will not lag far behind.

Having trouble finding a good auto mechanic? It's no wonder. A critical shortage of garagemen is a major problem today for car manufacturers as well as car owners. The assembly lines are turning out cars faster than trade schools can train mechanics to fix them. On top of that, school shop facilities can't always keep pace with the snowballing advances in car engineering. Complex equipment for class work is often costly and not adapted to classes fast enough.

Sixty-seven million cars, trucks and buses are now rolling over America's streets and highways. But there are only 775,000 mechanics to keep them going. That's a ratio of one mechanic for every 87 vehicles. (Has the garageman's job become depressionproof? The statistics make it look so.)

To hold at the present 1:87 ratio, the industry needs 40,000 new mechanics every year: half of that for normal year-to-year replacements, the other half for our climbing vehicle registrations. But here's the rub: Only a third that number of mechanics are getting out of school now. It's doubtful whether the supply will ever catch up with the demand for them.

Industry and education together are trying to narrow the gap. The Automobile Manufacturers Association and the American Vocational Association have begun a two-phased program that is designed to:

- Recruit more good students for instructors' training courses in auto mechanics. Scholarship funds are being set up for this at Wayne State University and the University of Illinois.
- Find out what it takes to make a good prospective auto mechanic. Said one Detroit expert: "Many students entering automotive programs are not really fitted for the trade, and stand little chance of success." Funds for researching the qualities and aptitudes of successful mechanics are going to the University of Michigan.

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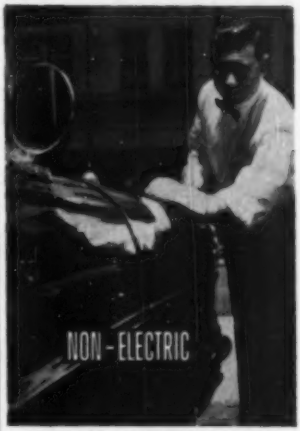

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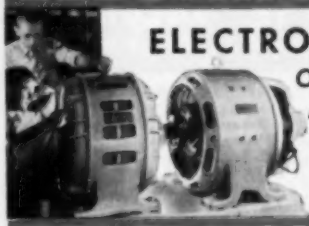

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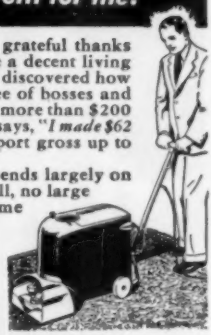

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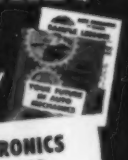

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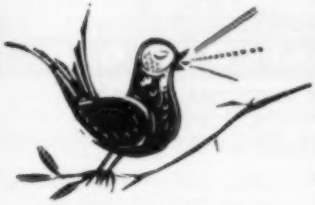

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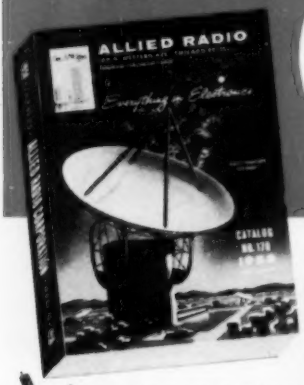

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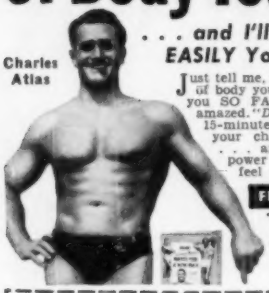

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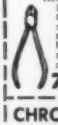

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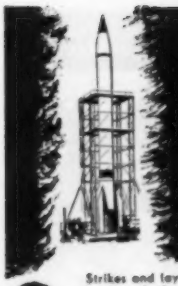

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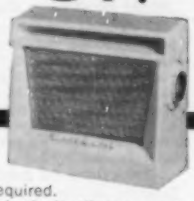

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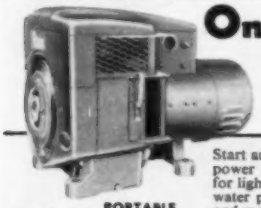

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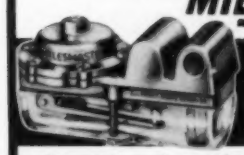

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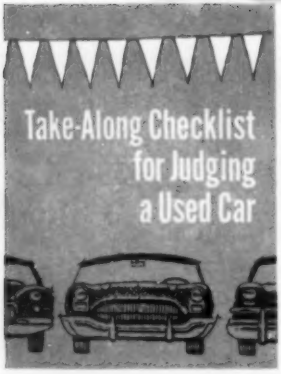

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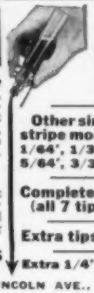

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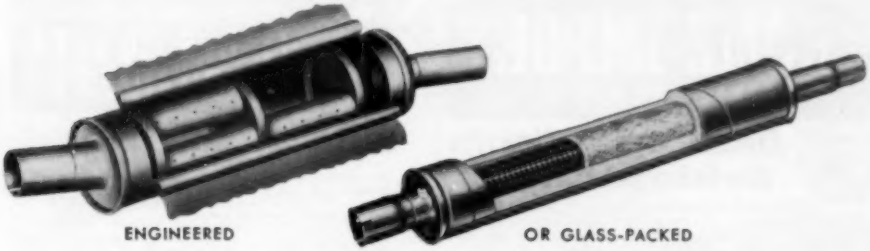

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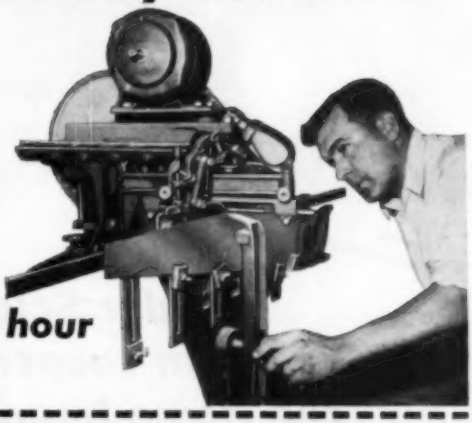

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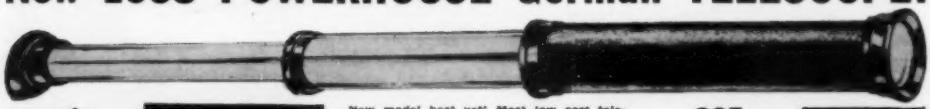

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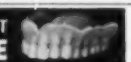

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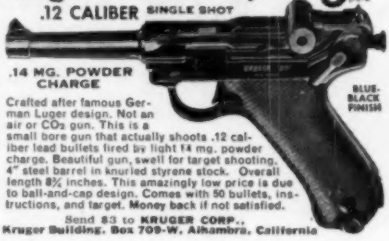

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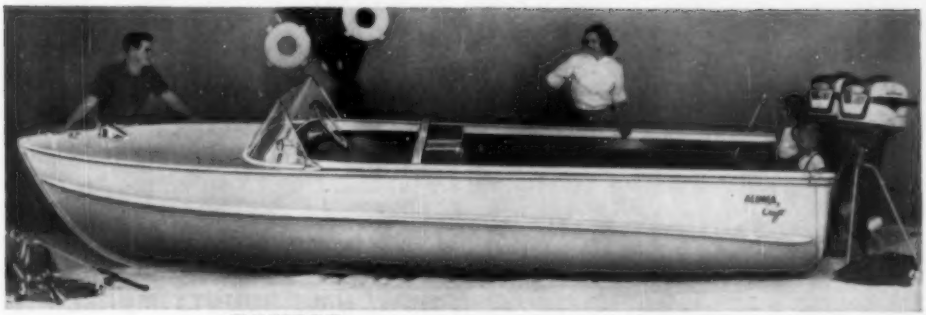

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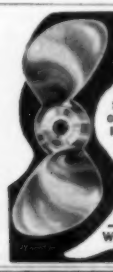

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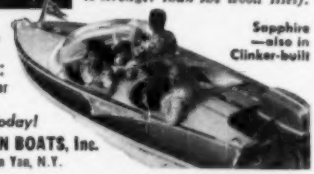

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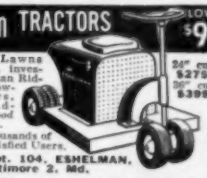

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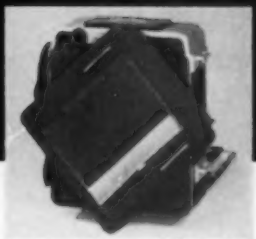

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One look at the Super Graphic 45 will tell you that this brand new camera means business! Though smaller than its predecessor, the Pacemaker Graphic, it has even greater versatility while maintaining the 4x5 format. Size and shape have been designed for utmost user convenience. All locks and releases are convenient to adjust, large enough and properly shaped for easy operation. Swings, tilts and shifts have "click stop" neutral positions. An electric tripping button for shutter and flash is located convenient to the left hand. Focusing scale and automatic flash calculator are on top of the camera. All flash and shutter connections are internally wired, eliminating dangling cords. Revolving back lets you take horizontally or vertically composed pictures with equal ease. See this advanced new camera at your Graflex dealer's or write Dept. PS-48, Graflex, Inc., Rochester 3, N. Y., for further information.

Front standard swings horizontally, tilts forward or backward, rises and shifts.

More Features...

- Automatic flash setting calculator.
- Front standard swings horizontally, tilts forward or backward, rises and shifts.
- New focusing hood for quiet, one-handed operation.
- Large, easy-to-handle coupled rangefinder cam and simplified mechanism for easy changing of cams.
- Integral rangefinder works even with wide angle lenses.
- Revolving back accepts all Graflex-made film accessories.
- Polarized 3-pin cord outlet in camera body connects to Graflite and Stroboflash and eliminates cords dangling from shutter.

Electrical body release for tripping shutter, Stroboflash and Graflite. Internal power supply and wiring.

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POPULAR SCIENCE
Monthly

HILLMAN MINX

ANGLIA

Facts, figures and driver reports on

8 Best-Selling Small Cars

METROPOLITAN

OPEL OLYMPIA REKORD

RAMBLER AMERICAN

RENAULT DAUPHINE

VAUXHALL VICTOR

VOLKSWAGEN

By Devon Francis

ON THE following pages POPULAR SCIENCE presents the results of tests on eight small sedans selling for less than $2,000. These tests cover their top speeds, acceleration and gas mileage, both at a constant highway speed and in stop-and-go driving, with two persons aboard.

Five of the eight cars are the biggest-selling sedans, over here, among the European imports. Two of the remaining three are made by European branch factories of U. S. manufacturers and widely distributed here through dealers in domestic cars. The eighth car is the only vehicle made in this country that is comparable in size with the European imports.

This study is concerned with price, performance, comfort levels and ease of handling. In weight, size, ride, economy and price, the little cars differ widely. They do share these characteristics: They are mechanically simple, and therefore are easy to keep in running trim. They are lighter in weight and their power output is low. So they are economical of fuel. All use regular gasoline, as opposed to extra-cost, premium grades. Most of them are, by a U. S. yardstick, shy on acceleration and speed. By and large, they are better made than U. S. cars. Reason: More rigid quality-control.

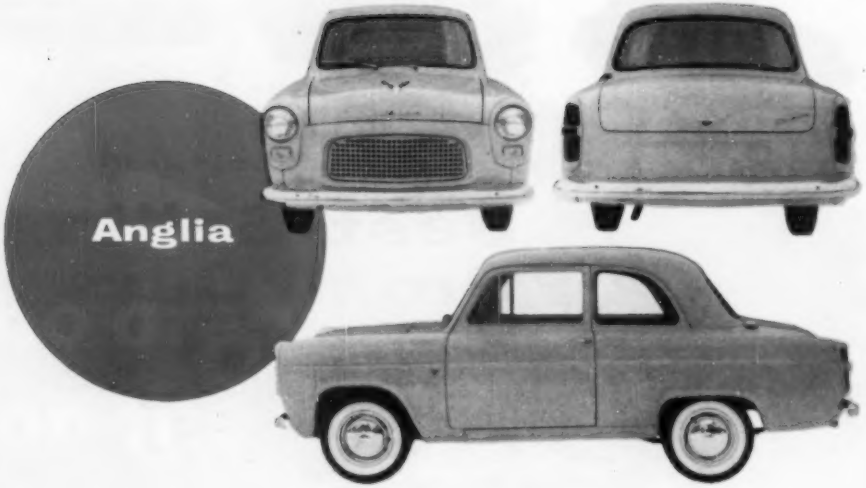
Regarding the charts: Prices are "factory-suggested retail" at New York, the main port of importation, and in some instances also at Gulf ports. Prices run up to almost $200 higher at West Coast ports and commensurately more at inland points where overland freight is a factor. Prices include federal excise tax and dealer "preparation and handling" charges, but no state or local taxes. The Rambler American price is retail at the factory, Kenosha, Wis.

Speedometer readings given are uncorrected for instrument error. But speedometer error at 60 miles an hour is cited.

Acceleration times given are through all gears, using optimum-performance shift points.

Fuel-consumption readings are based on refill at the pump.

For full report on each car, see the next eight pages



Specifications
Made in: England. Price: $1,539. Number of passengers: four.

Performance
Fuel consumption: stop-and-go, 23.2 m.p.g.; constant 50 m.p.h., 28.8 m.p.g.

Top speed: 70. Speedometer error: At indicated 60 m.p.h., car speed was 56 m.p.h.

Acceleration: 0-50 m.p.h., 19.2 sec.; 0-60, 28 sec.; 35-55, 12.3 sec.; 40-60, 14 sec.

Engine
Four-cyl. flathead; 36 hp. at 4,500 r.p.m.; torque, 52 lb.-ft. at 2,500 r.p.m.; bore and stroke, 2.5 X 3.64 in.; displacement, 71.55 cu. in.; compression ratio, 7:1; cooling system, water; engine position, front; car weight per hp., 49.5 lb.; fuel capacity, 8.5 gal.

Transmission, chassis, running gear
Forward speeds, three; transmission ratios (:1), 3.90, 2:01, 1; rear-axle ratio, 4.42; springing, coils in front, semi-elliptics in rear; steering ratio, 2¼ turns lock to lock; diameter of turning circle, 32.5 ft.; brake-lining area, 76.8 sq. in.; tire size, 5.20 X 13.

Weights and dimensions
Curb weight, 1,782 lb.; outside dimensions: wheelbase, 87 in.; overall length, 149.2 in.; width, 60.7 in.; height, 58.7 in.; tread, front 48 in., rear 47.5 in.; ground clearance, 7 in.

Inside dimensions: hip room, front 46 in., rear 36 in.; leg room, front 43 in., rear 36 in.; head room, front 36.7, rear 33.5 in.; distance, steering wheel to seat cushion with seat in mid-position, 6.7 in.; driver's-seat horizontal adjustment, 4 in.

Optional equipment: radio, heater, whitewall tires, temperature gauge, semi-automatic clutch, leather upholstery, bigger-capacity fan.

List of dealers available from: Ford Motor Co., Foreign Products Branch, 34 Exchange Pl., Jersey City 2, N. J.

"Well-built—but it proved to be a handful in a brisk crosswind"

Comment: This is the most austere—and the cheapest—of the British-made Fords. Even the Volkswagen must take second place to it as an unadorned, strictly utility vehicle. The Anglia is well built. Its noise level is exceptionally low. The outstanding attribute of this foreshortened little vehicle is its ability to scoot around, especially on wet or snowy footing. Beyond that, the buyer must expect no more than the low price entitles him to.

The engine power is too meager for a three-speed transmission. On the car tested, the clutch was inclined to grab. The vibration level was high, and considerable road shock was transmitted to the steering wheel. The gearshift linkage invited clashing against reverse when the transmission-mounted shift lever was moved from first to second. The heater, somewhat primitive and unsatisfactory in output, was so mounted as to interfere with the accelerator toe of a big-footed motorist.

Because the car is so light, it proved to be a handful in a brisk crosswind. It stored relatively little rolling energy. On the other hand, the visibility was good, and no one could quarrel with the riding qualities. The parallel-operating wipers afforded extra swept area on the windshield. As with all the extra-small imports, the Anglia poses the question of an additional driving hazard—it's harder for other motorists to see it.

Specifications

Made in: England. Price, $1,849 (a stripped version is $1,699). Number of passengers: four.

Performance

Fuel consumption: stop-and-go, 20.7 m.p.g.; constant 50 m.p.h., 32.3 m.p.g.

Top speed: 80. Speedometer error: At indicated 60 m.p.h., car speed was 57.2 m.p.h.

Acceleration: 0-50 m.p.h., 15.8 sec.; 0-60, 23 sec.; 35-55, 11.2 sec.; 40-60, 15.1 sec.

Engine

Four-cyl. OHV; 51 hp. at 4,400 r.p.m.; torque, 72 lb.-ft. at 2,200 r.p.m.; bore and stroke, 3.00 X 3.00 in.; displacement, 85 cu. in.; compression ratio, 8:1; cooling system, water; engine position, front; car weight per hp., 43.1 lbs.; fuel capacity, 8.7 gal.

Transmission, chassis, running gear

Forward speeds, four; transmission ratios (:1), 3.56, 2.47, 1.49, 1; rear-axle ratio, 4.78; springing, coils in front, semi-elliptics in rear; steering ratio, three turns lock to lock; diameter of turning circle, 34.2 ft.; brake-lining area, 92 sq. in.; tire size, 5.60 X 15.

Weights and dimensions

Curb weight, 2,200 lb.; outside dimensions: wheelbase, 96 in.; overall length, 162 in.; width, 60.7 in.; height, 59.5 in.; tread, front 49 in.; rear 48.5 in.; overhang, front 26 in., rear 40 in.; ground clearance, 7 in.

Inside dimensions: hip room, front 50.5 in., rear 51 in.; leg room, front 31 in., rear 34.2 in.; head room, front 33 in., rear 30 in.; distance, steering wheel to seat cushion with seat in mid-position, 5.5 in.; driver's-seat horizontal adjustment, 5 in.

Optional equipment: radio, heater, clock, oil gauge, ammeter, whitewall tires, automatic clutch.

List of dealers available from: Rootes Motors, Inc., 505 Park Ave., New York 22, N. Y.

"A recommended buy despite a number of driver annoyances"

Comment: The engine is quiet, smooth and full of snap. Its output in the pinches is a surprise and delight to the driver who has sampled other European flyweight power plants. The body construction is solid. Seat room, front and rear, is satisfactory. Driver visibility is good. The heater is more than adequate. The major instruments, centered on the panel (to accommodate a right-hand steering-wheeled installation in England, and left-hand abroad), call for too much eye travel.

The shift pattern, exactly the opposite to that in the U. S. with the added complication of another forward gear, is annoying. Starting in second gear is permissible at light load. The gears clash in speed-shifting between first and second, and second and third. First gear should be synchronized. Pedal pressures are light and easy, and the pedals are adequately spaced. The clutch is hydraulically operated. The electric wipers need a second speed. Their parallel-operation overlap, however, affords a superior swept area. The suspension is somewhat stiff. The steering ratio is too fast for easy parking effort. The owner's-handbook injunction to use premium gas is misleading—it applies only to low-octane European fuels. Regular U. S. gas is okay.

In the opinion of the writer, the Hillman—at the price—probably is the best buy among the more popular foreign cars selling under $2,000.

Metropolitan

Specifications
Made in: England. Price: $1,626. Number of passengers: two.

Performance
Fuel consumption: stop-and-go, 22.1 m.p.g.; constant 50 m.p.h., 33.5 m.p.g.

Top speed: 71. Speedometer error: At indicated 60 m.p.h., car speed was 59 m.p.h.

Acceleration: 0-50 m.p.m., 12 sec.; 0-60, 17.4 sec.; 35-55, 8.8 sec.; 40-60, 10 sec.

Engine
Four-cyl. OHV; 55 hp. at 4,600 r.p.m.; torque, 82 lb.-ft. at 2,400 r.p.m.; bore and stroke, 2.87 X 3.5 in.; displacement, 90.89 cu. in.; compression ratio, 8.3:1; cooling system, water; engine position, front; car weight per hp., 35 lb.; fuel capacity, 10.5 gal.

Transmission, chassis, running gear
Forward speeds, three; transmission ratios (:1) 2.84, 1.49, 1; rear-axle ratio, 4.22; springing, coils in front, semi-elliptics in rear; steering ratio, 2¾ turns lock to lock; diameter of turning circle, 35 ft.; brake-lining area, 76.8 sq. in.; tire size, 5.20 X 13.

Weights and dimensions
Curb weight, 1,938 lb.; outside dimensions: wheelbase, 85 in.; overall length, 149.5 in.; width, 61.5 in.; height 54.5 in.; tread, front 45.3 in., rear 44.8 in.; overhang, front 28.4 in., rear 36.1 in.; ground clearance, 6 in.

Inside dimensions: hip room, 49.7 in.; leg room, 41.7 in.; head room, 35.7 in.; distance, steering wheel to seat cushion with seat in mid-position, 6.7 in.; driver's-seat horizontal adjustment, 4 in.

Optional equipment: radio, heater, whitewall tires; standard equipment includes Continental spare, two-tone paint.

List of dealers available from: Sales Department, American Motors Corp., 14250 Plymouth Rd., Detroit 32.

"A watch-charm Rolls, with a quoted price that's misleading"

Comment: This car is a sort of watch-charm Rolls Royce—with all the disadvantages accruing from the attempt at shrinkage. It's saucy, with an extraordinarily good power-for-weight ratio. For a European, low-priced vehicle, it's a bomb on acceleration. Its short wheelbase puts it at the top of its class in maneuverability, with a minimum of clutch effort.

Built by Austin for American Motors and powered by an Austin A-50 engine, the car is astonishingly well equipped. It exudes an air of luxury-in-miniature.

Even a Continental spare-tire mount—now in vogue again—is standard equipment. So is a cigar lighter, missing on most low-cost imports. But, naturally, the Metro pitches on rough roadways. It seats only two unless somebody wants to lodge an infant on the unsprung cushion in back. An absence of vent windows makes fresh air a problem, especially in wet weather. The car tested tended to wander in crosswinds. The turn signals refused to cancel and the wipers did not return when switched off. The radio stations "drifted" on warmup. The lack of an engine-heat indicator was bothersome. Road noise was excessive, but shock was nicely damped out.

The quoted price is misleading—for the present, anyway, it's impossible to buy a Metro without radio, heater and whitewalls. So the car should be advertised at a true price of $1,774.

Opel Olympia Rekord

Specifications

Made in: Germany. Price: $1,987. Number of passengers: four.

Performance

Fuel consumption: stop-and-go, 29.6 m.p.g.; constant 50 m.p.h., 31.4 m.p.g.

Top speed: 71 m.p.h. Speedometer error: At indicated 60 m.p.h., car speed was 59 m.p.h.

Acceleration: 0-50 m.p.h., 16 sec.; 0-60, 22.2 sec.; 35-55, 12.5 sec.; 40-60, 13 sec.

Engine

Four-cyl. OHV; 56 hp. at 4,200 r.p.m.; torque, 84 lb.-ft. at 2,000 r.p.m.; bore and stroke, 3.15 X 2.91 in.; displacement, 90.8 cu. in.; compression ratio, 7.5:1; cooling system, water; engine position, front; car weight per hp., 35.6 lb.; fuel capacity, 10.5 gal.

Transmission, chassis, running gear

Forward speeds, three; transmission ratios (:1), 3.23, 1.68, 1; rear-axle ratio, 3.9:1; springing, coils in front, semi-elliptics in rear; steering ratio, 2.5 turns lock to lock; diameter of turning circle, 35 ft; brake-lining area, 109.1 sq. in.; tire size, 5.60 X 13.

Weights and dimensions

Curb weight, 1,995 lb.; outside dimensions: wheelbase, 100 in.; overall length, 174 in.; width, 63.6 in.; height, 56.7 in.; tread, front 49.6 in., rear 50 in.; overhang, front, 28 in., rear 45.9 in.; ground clearance, 6.7 in.

Inside dimensions: hip room, front 52.7 in., rear 53 in.; leg room, front 43.3 in., rear 39.3 in.; head room, front 36 in., rear 34.8 in.; distance, steering wheel to seat cushion with seat in mid-position, 5.7 in.; driver's-seat horizontal adjustment, 3.5 in.

Optional equipment: Radio, back-up lights, outside mirror, bumper guards, windshield washer. Heater is standard.

List of dealers available from: Sales Department, Buick Motor Division, Flint 2, Mich.

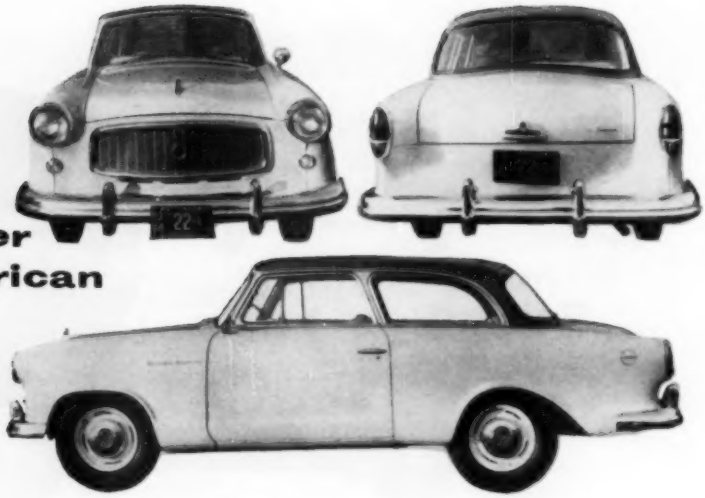
"A modernized Model A with a fresh bloom—but overpriced"

Comment: The best of the Opel is its looks, ride and items of passenger comfort. The worst of it is the price—it costs too much compared with other European automobiles in its price group and with, indeed, comparably equipped U. S. cars.

As described in POPULAR SCIENCE in March, this new little import is lively, comfortable and easy to drive. The first gear—cheers to GM—is synchronized. The accelerator pedal is sized so a man can get his foot on it. By European standards, the Opel is roomy. By U. S. standards, it's a sort of modernized Model A with a fresh bloom. By all odds, it conforms closest, among the imports, to what a customer over here thinks an automobile should be.

The cautious buyer can find fault with it. Its speed and acceleration don't match, for instance, those of the Hillman—despite a slightly bigger engine and considerably lower weight. That's due in part to transmission and axle ratios. The car tested couldn't be pushed much beyond an indicated 70 miles an hour but—to its credit—it didn't sweat in reaching that. The heating was only marginal on a cold day. The ribbon-type speedometer was hysterical, and speeds had to be averaged-out between swings.

The flow of Opels from the factory is skimpy and, as with many of the imports, the replacement-part problem should be explored thoroughly before purchase.



Rambler American

Specifications

Made in: U. S. Price: $1,789 (for Deluxe; a Super is $1,874). Number of passengers: five.

Performance

Fuel consumption: stop-and-go, 21.8 m.p.g.; constant 50 m.p.h., 24.6 m.p.g.

Top speed: 83 m.p.h. Speedometer error: At indicated 60 m.p.h., car speed was 56 m.p.h.

Acceleration: 0-50 m.p.h., 10.2 sec.; 0-60, 15 sec.; 35-55, 7 sec.; 40-60, 8 sec.

Engine

Six-cyl. flathead; 90 hp. at 3,800 r.p.m.; torque, 150 lb.-ft. at 1,600 r.p.m.; bore and stroke, 3.12 X 4.25 in.; displacement, 195.6 cu. in.; compression ratio, 8:1; cooling system, water; engine position, front; car weight per hp., 28.5 lb.; fuel capacity, 20 gal.

Transmission, chassis, running gear

Forward speeds, three; transmission ratios (:1), 2.61, 1.63, 1; rear-axle ratio, 3.78; springing, coils in front, semi-elliptics in rear; steering ratio, 4½ turns, lock to lock; diameter of turning circle, 36 ft.; brake-lining area, 139.4 sq. in.; tire size, 5.90 X 15.

Weights and dimensions

Curb weight, 2,571 lb.; outside dimensions: wheelbase, 100 in.; overall length, 178.2 in.; width, 73 in.; height, 57.3 in.; tread, front, 54.6 in., rear 55 in.; overhang, front 31 in., rear 46.9 in.; ground clearance, 6.7 in.

Inside dimensions: hip room, front 58 in., rear 45.2 in.; leg room, front 44 in., rear 37.5 in.; head room, front 35.2 in., rear 34 in.; distance, steering wheel to seat cushion with seat in mid-position, 7 in.; driver's-seat horizontal adjustment, 6 in.

Optional equipment: overdrive, automatic transmission, heater, radio, tinted glass, reclining seat, bigger tires, oil-bath cleaner, etc.

List of dealers available from: Sales Dept., American Motors, 14250 Plymouth Rd., Detroit 32.

"Probably the best of the small cars at the price"

Comment: This is the Rambler that was introduced in 1951 and discontinued in 1955. The changes are negligible. The flathead engine (the only Six among the eight cars tested, the rest having four cylinders), designed 18 years ago, still has sparkle.

The car requires surprisingly little shifting. Gear engagement is smooth and positive, matched only by the Opel and Volkswagen. Instruments are grouped nicely in front of the driver. The heater controls are simple and the volume of warm air ample, but the fan was noisy. Body construction and door fits were superior, as in most frameless cars. Little road shock is transmitted to the steering wheel. Height of the entrance room is poor. Head room is scanty. The speedometer needle is stable but the dial graduations need improvement. Unlighted panel controls make night driving a chore for the person not acquainted with the car. The dimmer switch is too close to the clutch pedal. The car lugs below 15 miles an hour. Visibility all around is excellent.

This was one of only two cars of the eight tested that had not been run-in. (The other was the Metropolitan.) The odometer showed only 100 miles. Therefore, the buyer can expect better performance after 3,000 or 4,000 miles than is indicated here. In the writer's opinion, the Rambler American probably is the best buy, at the price, among the eight.

Renault Dauphine

Specifications

Made in: France. Price: $1,645. Number of passengers: four.

Performance

Fuel consumption: stop-and-go, 28.2 m.p.g.; constant 50 m.p.h., 30 m.p.g.

Top speed: 74. Speedometer error: At indicated 60 m.p.h., car speed was 57 m.p.h.

Acceleration: 0-50 m.p.h., 19 sec.; 0-60, 29 sec.; 35-55, 17.8 sec.; 40-60, 19.8 sec.

Engine

Four-cyl. OHV; 32 hp. at 4,250 r.p.m.; torque, 48.3 lb.-ft. at 2,000 r.p.m.; bore and stroke, 2.28 X 3.14 in.; displacement, 51.5 cu. in.; compression ratio, 7.25:1; cooling system, water; engine position, rear; car weight per hp., 43.4 lb.; fuel capacity, 8.5 gal.

Transmission, chassis, running gear

Forward speeds, three; transmission ratios (:1), 3.7, 1.8, 1.07; rear-axle ratio, 4.37; springing front and rear, coils; steering ratio, 4¼ turns lock to lock; diameter of turning circle, 29.1 ft.; brake-lining area, 55.2 sq. in.; tire size, 5.00 X 15.

Weights and dimensions

Curb weight, 1,389 lb.; outside dimensions: wheelbase, 89.3 in.; overall length, 155.3 in.; width, 60 in.; height, 56.7 in.; tread, front 49.2 in., rear 48 in.; overhang, front 29.5 in., rear 33.5 in.; ground clearance, 6 in.

Inside dimensions: hip room, front 20 in. each (split seats), rear 48 in.; leg room, front 40 in., rear 36 in.; head room, front 37.5 in., rear 35.5 in.; distance, steering wheel to seat cushion with seat in mid-position, 7.8 in.; driver's-seat horizontal adjustment, 5 in.

Optional equipment: automatic clutch, whitewall tires, sun roof, radio. Heater and automatic choke are standard.

List of dealers available from: Renault, Inc., 425 Park Ave., New York 22, N. Y.

"It has exquisite touches—this car should be a better buy"

Comment: For an "Americanized" vehicle with a Champs Elysées accent, this car should be a better buy than it is. It has a host of exquisite touches. You can lock the steering wheel with the ignition key—an ideal frustration for thieves. Choking is automatic. The engine, for its size, is one of Europe's best. Driver visibility is good. The ride is soft, the cornering excellent. Overall maneuverability may well be tops among the more popular imports. The owner manual is the most complete.

Yet the Dauphine incorporates a bag of annoyances peculiar to itself. On the car tested, too much reach was required in moving the transmission-mounted shift lever. There was inadequate toe clearance above the pedals. In an anxiety to shrink the body, the maker intrudes the wheel wells into the front compartment. Passengers have to stoop-and-squat to get in. The doors lack hold-opens. The transmission whines. Too-liberal use of plastics cheapens an otherwise attractive interior, and inclusion of two-toned horns for town and country is—for the U. S. A.—pure caprice.

But the real fault of this car is low power and too-ambitious transmission and axle ratios. Above 40 miles an hour, the remarkably quiet little engine begins sighing over its chores. It has a marked reluctance for passing at highway speeds. Will Paris please synchronize that first gear?

Specifications
Made in: England. Price: $1,987. Number of passengers: four.

Performance
Fuel consumption: stop-and-go, 29.9 m.p.g.; constant 50 m.p.h., 32 m.p.g.

Top speed: 80. Speedometer error: At indicated 60 m.p.h., car speed was 57 m.p.h.

Acceleration: 0-50 m.p.h., 20 sec.; 0-60, 26.4 sec.; 35-55, 10.6 sec.; 40-60, 11.2 sec.

Engine
Four-cyl. OHV; 55 hp. at 4,200 r.p.m.; torque, 78 lb.-ft. at 2,000 r.p.m.; bore and stroke, 3.12 X 3.00 in.; displacement, 92 cu. in.; compression ratio, 7.8:1; cooling system, water; engine position, front; car weight per hp., 38.9 lb.; fuel capacity, 9.6 gal.

Transmission, chassis, running gear
Forward speeds, three; transmission ratios (:1), 3.18, 1.63, 1; rear-axle ratio, 4.12; springing, coils in front, semi-elliptics in rear; steering ratio, 3¾ turns lock to lock; diameter of turning circle, 34 ft.; brake-lining area, 92 sq. in.; tire size, 5.60 X 13.

Weights and dimensions
Curb weight, 2,140 lb.; outside dimensions: wheelbase, 98 in.; overall length, 166 in.; width, 62 in.; height, 58 in.; tread front and rear, 50 in.; overhang, front 26 in., rear 42.6 in.; ground clearance, 6.5 in.

Inside dimensions: hip room, front and rear 52 in.; leg room, front 42 in., rear 41 in.; head room, front and rear, 35 in.; distance, steering wheel to seat cushion with seat in mid-position, 6.8 in.; driver's-seat horizontal adjustment, 4 in.

Optional equipment: radio, windshield washer, outside mirror. Heater, undercoating standard.

List of dealers available from: Sales Department, Pontiac Motor Division, Pontiac 11, Mich.

"The coachwork is superb, but acceleration is sluggish"

Comment: The Vauxhall (like the Opel) probably will find the going hard against its small-car competition. It's high-priced. On the credit side, the car is comfortable. Steering, through a small, 16-inch wheel, is firm. The brakes are excellent. Visibility from the driver's seat is superior. The engine is lively. GM wisely synchronized all the forward gears.

But there are debits. The transmission on the car tested shifted hard. Engine warmup was slow. The road shock transmitted to the steering wheel was excessive. The car had front-end wander in wind at high speed. Car weight per horsepower called for a higher axle ratio, or four speeds. Acceleration was sluggish. Control pedals were adequately spaced but too small—they could be a hazard to a motorist accustomed to bigger ones. Entrance room was sufficient in front but, with a stepdown, meager in the rear. Wave lengths on the radio supplied (to be real picayunish) were graduated in meters, which complicated station-finding, and the thing tuned backward.

On the other hand, luggage space, in Detroit's best tradition, was exceptionally good, and the coachwork superb. The springing met rough roads with dignity. For the driver, anyway, there was ample leg room.

Next month: a special section packed with new slants on

Specifications

Made in: Germany. Price: $1,545. Number of passengers: four.

Performance

Fuel consumption: stop-and-go, 32 m.p.g.; constant 50 m.p.h., 43 m.p.g.

Top speed: 73. Speedometer error: At indicated 60 m.p.h., car speed was 56 m.p.h.

Acceleration: 0-50 m.p.h., 17 sec.; 0-60, 30 sec.; 35-55, 12.2 sec.; 40-60, 13 sec.

Engine

Four-cyl. OHV, horizontally opposed; 36 hp. at 3,700 r.p.m.; torque, 56 lb.-ft. at 2,000 r.p.m.; bore and stroke, 3.03 X 2.52 in.; displacement, 72.7 cu in.; compression ratio, 6.6:1; cooling system, air; engine position, rear; car weight per hp., 51.1 lb.; fuel capacity, 10.5 gal., 1.3 gal. reserve.

Transmission, chassis, running gear

Forward speeds, four; transmission ratios (:1), 3.6, 1.88, 1.23, .82; rear-axle ratio, 4.4; springing, torsion bars, each wheel independent; steering ratio, 2.4 turns lock to lock; diameter of turning circle, 36 ft.; brake-lining area, 94.2 sq. in.; tire size, 5.60 X 15.

Weights and dimensions

Curb weight, 1,802 lb.; outside dimensions: wheelbase, 94.5 in.; overall length, 160 in.; width, 60.5 in.; height, 59 in.; tread, front 50.7 in., rear 49.1 in.; overhang front and rear, 32.7 in.; ground clearance, 6.8 in.

Inside dimensions: hip room, front 19 in. each (split seats), rear 52; leg room, front 43.5 in., rear 36.5 in.; head room, front 38 in., rear 34 in.; distance, steering wheel to seat cushion with seat in mid-position, 7 in.; driver's-seat horizontal adjustment, 6.5 in.

Optional equipment: radio, gas gauge, whitewall tires, leatherette upholstery, outside mirror, etc. Heater is standard.

List of dealers available from: Volkswagen of America, 476 Hudson Terrace, Englewood Cliff, N. J.

"Noisy transmission, but can 200,000 U. S. owners be wrong?"

Comment: The VW has won the popularity sweepstakes among imported cars hands down, and 200,000 U. S. owners can't be wrong. This vehicle is exceptionally well made and rugged. It probably is the most potentially trouble-free car sold here. *But,* always carry a spare fan belt along—belt breakage is the VW's sole design weakness. A big rear window now, for the first time, affords adequate rear visibility. Maneuverability and handling characteristics are excellent. The uninitiated will find the scanty torque output annoying. The front end windwanders when the forward-positioned fuel tank runs low.

An optional gas gauge is welcome. Otherwise, the driver doesn't know that his main tank is dry and that he must turn on his reserve, until the engine sputters and dies.

The springing is hard at light load. The transmission is excessively noisy. On the car tested, the shift lever occasionally jumped out of first gear on long, steep hills. First gear needs synchronizing. A tricky shift into reverse becomes a chore when the gears don't mesh readily. Some owners have nightmares that an elephantine car parked ahead of them will back on to that sloping front end, sight unseen.

used-car buying—and a booklet on how to check a used car

What We Know About

The face of the moon has been painstakingly mapped . . . but what's on the other side?

the Moon — So Far

Look hard, next full moon (April 3, May 3). Our oldest-established permanent satellite looms over the trees, familiar and close, yet mysterious and distant. Contrary to popular opinion, the moon is not always the same. And it's going to change more. We are ready to stretch across 240,000 miles to touch it, test it and put it to work—as an earth-encompassing observation post, as the staging area for expeditions through the universe.

What is the moon like? We now know about just one side. Surprisingly, we know that side very well, better than some parts of the earth. Here are the facts: fascinating details painstakingly established, puzzling mysteries waiting for explorers to solve. Embark below for your armchair tour of Moon Number One.

"LEIBNITZ MOUNTAINS. The highest peaks of all, outranking Everest . . . THE SEA OF FERTILITY. One of the larger seas of the Western Hemisphere . . . NEWTON. The deepest of the craters . . ." Absorbed in the scenic wonders described in your guidebook, you may be unprepared for an outstanding impression of your first visit to the moon.

That's the powder. A blanket of it covers everything, even steep slopes of jagged mountains. Perhaps a foot deep, the glassy stuff yields underfoot like quicksand, and you must learn the knack of getting around in it. Static charges make it cling to your space suit and the window of your space helmet. Although fine as face powder, it isn't like dust, since there's virtually no air for it to float in. It's an odd sight to see the powder settle instantly, after you stir it up by wallowing through it or by skiing over it.

WHAT'S on the moon—the powder and the rest—will become firsthand experience as soon as rocket ships begin plying outward from earth's man-made space stations. For it stands to reason that our nearest celestial neighbor, whose average distance is only 238,857 miles, will be the first one visited by spacemen. So declares a British astronomer, Patrick Moore, secretary of the British Astronomical Association's lunar section, and a leading member of the British Interplanetary Society.

His book, *A Guide to the Moon*, offers would-be voyagers to Luna, by telescope or spaceship, a veritable travel manual. Places they should visit, and sights they'll see, are described in the light of recent findings.

Pointed out, too, are mysteries of the moon that may be fully solved only when the first rocket ship blasts down to a landing: Is there life on the moon? Has it any atmosphere? Are volcanoes still active? What's on the other side?

Today, these questions remain unanswered, even though the face of the moon that is turned toward us has been mapped better than the interior of Greenland. To an observer at the world's most powerful telescope, the moon appears only 24 miles away. The best photographs of its rugged and pitted surface reveal details only a few yards across. Enjoying such an excellent view of the moon's 2,160-mile-wide disk, astronomers have discerned more than 10,000 different features.

Upward of 700 of the most prominent ones have received names. The moon's "seas," "oceans," "bays," and "marshes" once were believed to be sheets of water. Today we know there's no water on the moon, and these great dark areas are vast plains—but early observers' fanciful names for them have stuck. Craters bear the names of scientists and other notables, past and present, with mythological characters thrown in; and some mountains are named after famous ranges on earth.

If explorers were ready to start for the moon today, they could take along splen-

did maps of these surface features. Probably the best, by Dr. H. P. Wilkins, British astronomer, was published in a 100-inch-diameter edition in 1951.

And an expedition might do well to carry the *latest* maps! For astronomers no longer consider the moon, as they once did, a dead and changeless world.

That view was held by the two foremost lunar observers of the nineteenth century, Wilhelm Beer and Dr. Johann Mädler. They completed a lunar map and a book on the moon that were masterpieces of thorough work. Then they quit. Why observe the moon further?

THIRTY years later, however, an astronomer looked in vain for a deep six-mile-wide lunar crater called Linné that had been well known to them. Linné had vanished. Where it had been, there was only a white patch, which marks the spot to this day. The most likely guess of many is that landslides, triggered by a "moonquake," caved in the crater's walls and destroyed it.

Imagine a moon explorer witnessing such a cataclysm at close range—cliffs falling away, the lunar landscape changing before his eyes. It would be all the more awesome because it would happen in silence—there cannot be enough air on the moon to carry a whisper of sound.

Close observers have since found other mystifying developments on the moon. In 1939, Moore, the author of the lunar guidebook, himself observed a dense fog that filled a whole crater with a whitish mist. With no water to form clouds, what could the mist be? Carbon dioxide seems a reasonable guess to Moore. And since this gas is given off in volcanic eruptions, mists seen by him and others may mean the moon still has active volcanoes.

The most remarkable object on the moon, perhaps, is the 29-mile-wide, 5,000-foot-deep crater Aristarchus. Its central peak is the moon's brightest spot, even shining starlike after dark by reflected light from the earth. But still more interesting are dark bands, radiating like spokes from the central peak to the outer walls and up them.

Mysteriously these markings wax and wane. They darken progressively outward after sunrise—then shrink and fade toward the end of the weeks-long lunar "day." Through a powerful telescope, the gray-bordered dark streaks resemble the "canals" of Mars.

Then is there life on the moon—as the famous canals on Mars too may be signs of life? Along surface cracks of volcanic origin, Moore suggests, a primitive form of lunar vegetation—lichens or mosses—may develop under the sun's warming rays and revert to dormancy during the bitter-cold period of darkness. Volcanic carbon dioxide gas leaking from the fissures might sustain its existence.

A LUNAR newspaper would have had sensational news to report in April, 1948. A tiny brilliant flash of orange-yellow light was observed then just within the crater Plato. It must have marked the impact and explosion of a great meteorite—perhaps as big as the one that struck Siberia in 1908 and leveled trees 20 miles away. A few similar observations are on record.

But the most interesting thing about them is their extreme rarity. For if the moon had no atmosphere at all, it has been calculated, the flash of a 10-pound meteorite's impact would be visible from earth with the naked eye, and about 100 such flashes would be seen yearly. Since we don't, is the moon totally "airless"?

That the moon can have no more than a trace of atmosphere is evident from the usual absence of a lunar twilight (rare exceptions have been reported) and the lack of refraction or light-bending when the moon's edge obscures a star. But an atmosphere 1/10,000 as dense as the earth's, at surface level, could escape

[*Continued on page 270*]

Next Month: Timetable to the Moon

When will we get there? How? What will we do there? Why? Scientists already have it worked out, step by step. May POPULAR SCIENCE *will bring you the full story: an authoritative advance report on our schedule for exploring the moon, by Dr. I. M. Levitt, director of the Fels Planetarium at Philadelphia's Franklin Institute.*

Now ad men have a new way to persuade you. They can pop a suggestion into your mind, using TV or movies, without your knowing it

TV's New Trick: Hidden Commercials

By Wesley S. Griswold

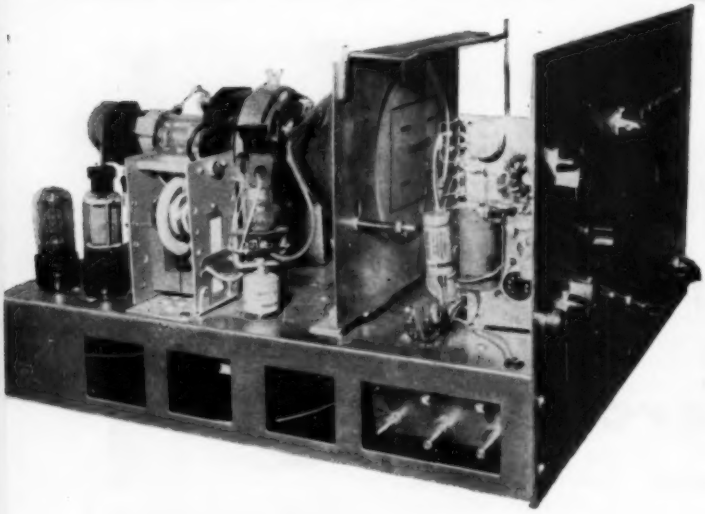
PROBABLY you've heard about—perhaps even worried about—a revolutionary new way to beam messages into the human mind. Especially suited to TV and movies, the new idea-injecting technique is said to work while you, all unawares, are innocently enjoying the program. The idea-words appear superimposed on the picture images too fast and too dimly to be seen in the normal way. Yet they register on your mind.

Despite rejection by the national networks, uneasy skepticism by the F.C.C. and alarm from people who fear that this strange development may bring wholesale invasion of privacy and risk of political tyranny, two means of reaching people's subconscious minds by television are currently being tested.

This month one of them, called Precon TV, was scheduled to be tried out on a large audience of TV watchers in and around Los Angeles. It was to have been Precon TV's first big showing. Its rival, Subliminal Projection, about which almost no technical details have been released, has already ventured on the air in Bangor, Me., and on a Canadian national hookup. Results for Subliminal Projection: inconclusive.

For its debut on independent Station KTLA, Precon TV did not plan to use advertising. Instead, public-service messages—like "Drive Safely," "Support Your Community Chest," or "Don't Be a Litterbug"—were to be tucked away into the telecast picture. But after this plan was announced, so much public criticism of the new technique boiled up that the trial was postponed. Controversy over these idea-injecting systems has swirled around three issues: (1) Are they legally proper? (2) Are they ethically acceptable? (3) And do they really work at all?

PRECON TV has a long history behind it. (The trade name comes from the word "preconscious," meaning "below the level of conscious awareness." "Subliminal"



HOW IT WORKS: The heart of Precon TV is a little flying-spot scanner and a frame holding a three-by-four-inch text. Pictures of the message are made with a rapidly pulsing light and intermixed with the regular video signals at a different rate per second. The aim: a message that the viewer doesn't realize he sees—he "feels" the message instead.

means the same thing.) Its inventors, Dr. Robert E. Corrigan of Los Angeles and Prof. Hal C. Becker of New Orleans, both men now in their mid-thirties, have been testing the theories and working parts of Precon for the past eight years. Patents were applied for early in 1955, but have not yet been issued. Consequently, the inventors decline to tell everything about their creation, though they have revealed the essentials.

The basic equipment, the means of sprinkling television programs with invisible but receivable messages, is contained in a rectangular metal box about half the size of a standard table-top TV set. Its power unit, in a separate, much smaller container, runs on house current.

This equipment is a kind of electronic mixing bowl, where printed information can be subtly stirred in with pictures. Inside the main Precon TV cabinet, along with 17 vacuum tubes and a photo multiplier, is a little flying-spot scanner and, in front of its round face, a small frame for holding the text to be scanned. The text is printed on a transparent plastic slide, on a three-by-four-inch space.

Picture signals from image-orthicon tubes in studio cameras focused on live performances, or from iconoscopes recording filmed scenes, are piped into the Precon TV apparatus on their way to the station's antenna. To understand what happens to them in the Precon blender, remember that it takes one-thirtieth of a second for a cathode-ray tube to project one complete picture image on a television screen. In that time it has to scan the picture twice, each perusal taking one-sixtieth of a second.

INSIDE the Precon TV cabinet, with the aid of the pulsed light emitted by the flying-spot scanner, the printed message is superimposed on the incoming picture signals *every other* one-sixtieth of a second. (The rate of mixture can be varied, as can the intensity of the pulsed light, which normally is less than one-third as bright as that of the picture signals.) The well-mixed video brew then flows on to the station's antenna, to which the program's sound signals, not involved in Precon TV, proceed independently.

Prof. Becker, an electronics engineer and physicist who teaches experimental neurology at Tulane University, points out a fascinating quirk: When you suspect you're watching a Precon program, you can find out what the hidden message is by spreading the fingers of one hand and moving them rapidly up and down in front of your eyes. By varying the rate of this movement, you'll soon find and match the rate at which the Precon message is being pulsed. Then you'll be able to read it.

"THE two questions we are most often asked about Precon," said Dr. Corrigan, a former fighter pilot who is now a psychologist for the Douglas Aircraft Co., "are 'How do you know that it works?' and 'Is it dangerous?'

"We have found ample proof that it works," he continued, "in exhaustive experiments at Tulane University that we have been conducting since 1950. In the course of finding that proof, we also became convinced that the Precon technique of communication can't be dangerous. There is no possibility of brainwashing by means of Precon, for each man is his own censor. His preconscious mind responds to Precon messages in complete accord with his likes and dislikes. There is no better chance of putting something over on his preconscious mind than there is of hoodwinking his conscious mind."

Corrigan and Becker discovered people's built-in censorship in tests in which three different types of words were very rapidly projected on a screen. Some of the words were neutral—like "stove," "table" and "rug." Some had emotional impact—"scream," "blood," "hate." Others were obscene words.

In repeated trials, the speed at which each word was flashed on the screen was slowed until the person being tested could say that he definitely had seen it. The researchers found that the emotional and obscene words had to be shown two or three times slower than the neutral words before people watching the screen could recognize them. Corrigan and Becker took this as firm evidence that the people were resisting and censoring upsetting words.

Next, in addition to calling out when they could identify a word, the subjects were asked to press a little lever as well. It was then discovered that not only did they push the lever sooner than they reported seeing the word—thus proving preconscious perception—but they reacted preconsciously to emotional and obscene words precisely as they did when conscious of them. They were censoring them without being aware of it.

FURTHER tests showed, they contend, that people can be taught preconsciously. Corrigan and Becker arranged to give their subjects tiny electric shocks whenever certain neutral words were flashed on the screen. Then the shocks were stopped, but when the words that had been associated with them appeared again, the subjects reacted to them preconsciously as if they were words highly charged with emotion. They had learned, without realizing it, to attribute a new and painful meaning to harmless words.

The Precon developers gave groups of people jumbled letters to rearrange into actual words. Before the test began, they showed the answers on a screen, too fast for anyone in the room to see. Preconsciously they were seen, however, and comparative tests indicated that the subjects solved the puzzles 15 to 46 per cent faster when the answers had been slipped to their subconscious minds in advance.

Finally, Corrigan and Becker expanded their experiments to theater-size audiences. They showed movies—color cartoons—in which printed information was hidden from conscious view. In one case, geometric symbols—a triangle, a circle

[*Continued on page 252*]

FOOD FOR THOUGHT: An advertising slogan on a small strip of transparent plastic is being fed into the Precon picture scanner by Prof. Hal C. Becker as the co-inventor, Dr. Robert E. Corrigan, watches. Lighted at one-third normal, the words are "buried" in the regular TV picture.

Talking Prowl Car Warns Wayward Drivers

TRAFFIC cops in at least four states, so far, are enthusiastically using a new safety device that fills the wide gap between a dirty look and a summons. It's a powerful public-address outfit installed in a car. Mobile p.a. systems are nothing new; but this one, called the Electro-Talker, has a built-in tape recorder that can broadcast the same 15-second message over and over.

Already some 35 "talking cars" are on the road. State, county and city police departments operate most of them. Maine has some, and so do Fredericksburg, Va., Detroit, Montreal, Poughkeepsie and Nassau County, L. I. But you'll also find such cars driven by the New York City Fire Department, the Vermont Department of Forests and Parks, Pennsylvania civil-defense units, and the Arabian-American Oil Co. overseas. The makers of Electro-Talker, the Municipal Street Sign Co. of Brooklyn, put 18 months into the development of the original model.

"You're too close for this speed—pass or drop back"

When this driver got the message, he hesitated, then pulled out and passed. The rear-fender speaker proved the most effective; it could be heard best and, because motorists could see it, they weren't startled.

"Thank you . . . Thanks very much"

This truck pulled over to let us pass safely as it crept up a long hill. When we drew ahead, Dr. Toth switched on the rear speaker and expressed his appreciation. The amazed truck driver waved and grinned.

One of Municipal's best unpaid salesmen is the training car of New York University's Center for Safety Education. As a free service, Dr. William Toth tours the country, training police and safety officials in the use of highway safety devices like radar. Roadside speeches to large groups strain the vocal chords so when the Ford Motor Co. donated another car to the Center not long ago, the safety men had an Electro-Talker installed in it. Dr. Toth soon found himself spending more time demonstrating the Talker itself as a safety device than using it for speeches.

Recently I rode in the NYU "talking car" from New York to Cumberland, Md., where state safety officials were meeting. The photos tell the story of that trip.—*Edward D. Fales Jr.*

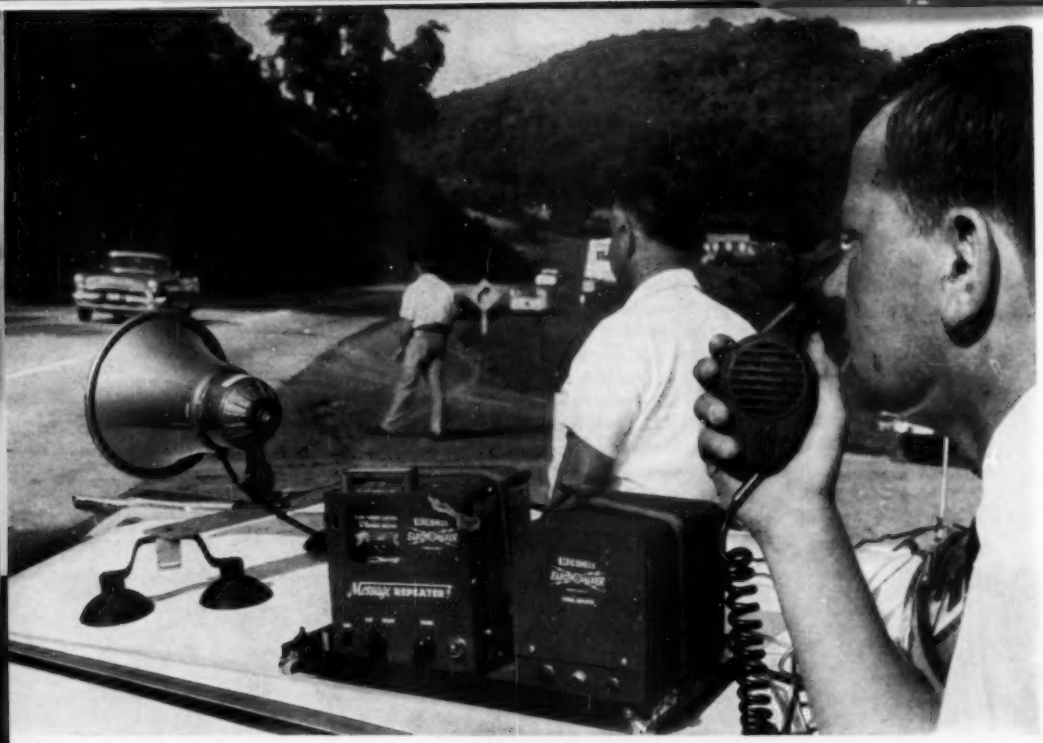
HEART OF ELECTRO-TALKER consists of this tape recorder and amplifier. A converter in the trunk supplies 110 volts from the car battery. There are three speakers: one behind the front grille, one on a rear fender, one that's portable. Holding mike is Dr. William Toth of NYU.

"Your right front tire is getting soft"

Bong . . . Bong . . . Bong . . . Bong

Heading south on the Jersey Turnpike, we tried to warn a driver ahead, but in the rain our front speaker failed to penetrate his closed windows. We passed him and switched on the rear speaker. He pulled off.

We were doing 50 when a car threatened to pull in from a side road. We gave him the gong (a recording of the mellow notes of an old dinner bell). He stopped. A horn might have irritated him into going ahead.

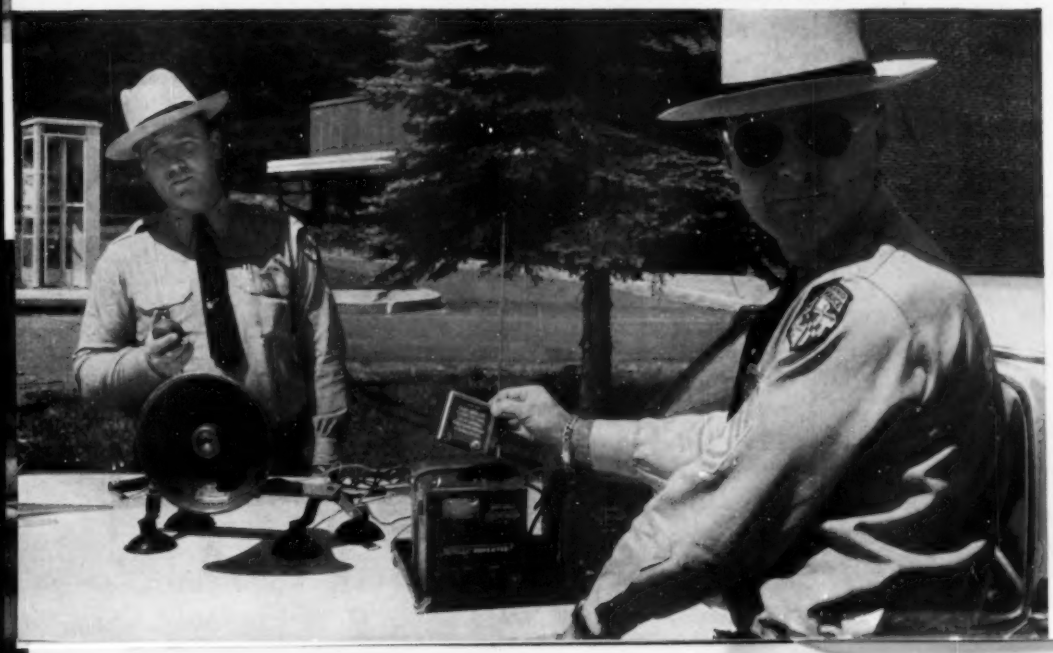


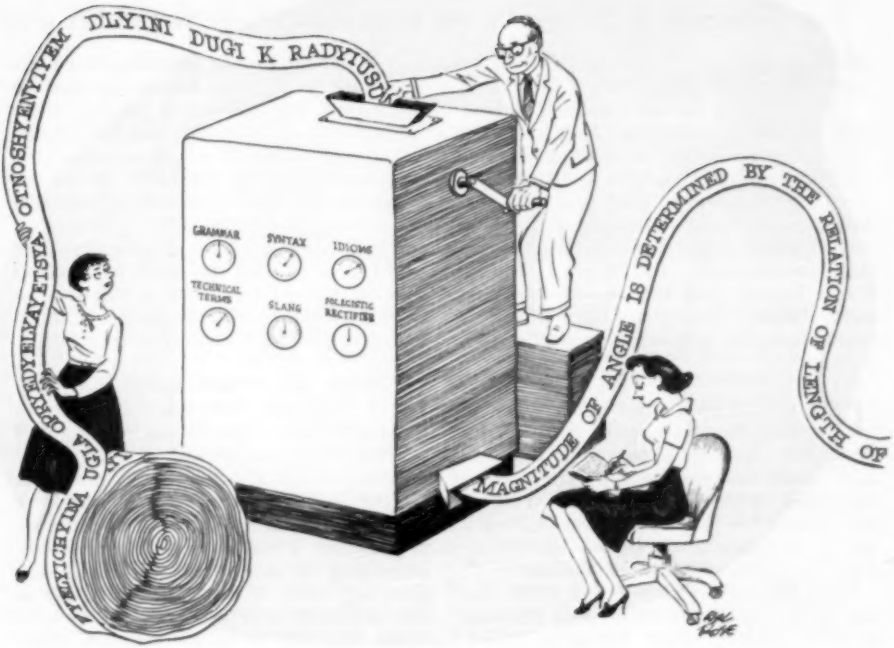
"Slow down, slow down —accident ahead"

Motorists are cautioned near Cumberland, Md., as safety officials test the equipment under actual highway conditions. Here portable speaker sits atop hood alongside control units. Full-volume range is a mile.

"Take it easy . . . This is a 30-mile zone"

State police drop a 15-second recording into the message repeater. Officer in background can cut in with his mike whenever he spots a driver who rates a little personal attention from the constabulary.





Breaking the Language Barrier

Each year, millions of reports on scientific research are published—a big fraction of them in foreign languages. In this mass of Russian, Dutch, Chinese, Hindustani data are clues to H-power, interplanetary flight, more powerful batteries, longer-wearing tires. The trouble is: Too few scientists and engineers read foreign languages. What we need is a machine to read one language and type in another: an automatic translator. *We're trying to build—not one, but several. Engineering problems? Fantastic. Here's where we stand now.*

By Hartley Howe

THE girl sat at the keyboard and punched onto cards the words on the sheet before her. *Vyelyichyina ugla opryedyelyayetsya,* she banged out, *otnoshyenyiyem dlyini dugi k radyiusu* . . . Red lights flashed on and off across a central control panel as the cards were fed into a big IBM computer. There was a moment of suspense, finally broken by the chattering of the automatic printer. "Magnitude of angle," it spelled across the page, "is determined by the relation of length of . . ."

The machine was "translating" the

Word order is tricky: "Lion kills man" and "man kills lion"

Russian sentences into English—automatically printing 2½ lines a second.

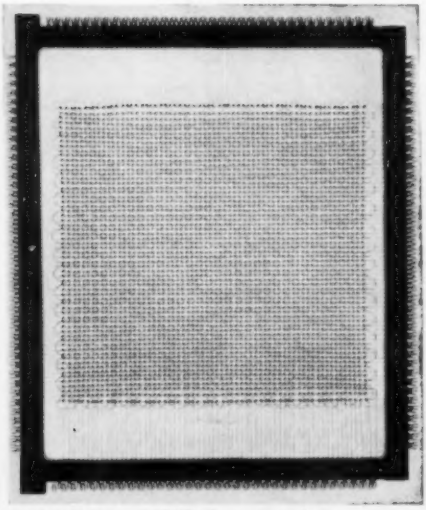
It was only a demonstration. The Russian texts were preselected by the experts who programed the computer; the vocabulary was tiny and the sentences simple. But Georgetown University's translating computer was a portent of things to come. Today, scientists in several countries—particularly the United States, Great Britain and Russia—are working out the theory behind machines that may break down the language barriers between nations.

THE urgent need is for quick, working translations of technical research reports and scientific papers. The linguists and mathematicians don't expect their machines—once they get them—to translate poetry or plays or novels. Literary shades of meaning will be too delicate for even the most complicated machine.

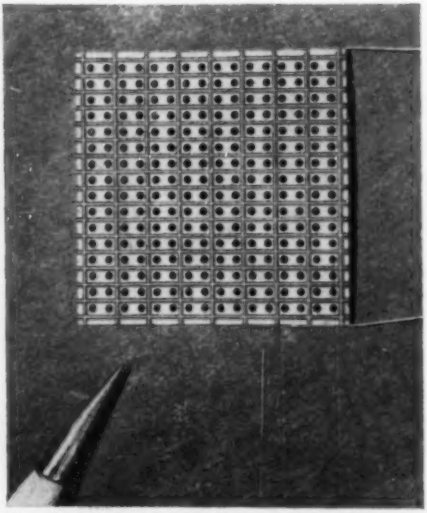
In technology, it's a different story. Today scientists can't keep up with progress in their fields in other countries. Sometimes they are held up by problems that have been solved elsewhere. An example: A paper on electric switching networks published in Russian was overlooked by Americans who needed it *for five years* while American scientists painfully duplicated much of the work, at an estimated unnecessary cost of $200,000. As for the Soviet moons: The truth is that American scientists worked frantically to tune in on their signals—only to find later that they could have learned the exact frequencies months beforehand from articles in a Soviet amateur-radio magazine that we had, but didn't get around to translating.

RUSSIA does it differently: An army of linguists abstracts into Russian some 400,000 articles on engineering and science every year, as well as making full translations on request. Right now, the United States can't come near matching that setup. Even if we double the number of Russian scientific journals that are translated or abstracted, which is the plan for 1958, it won't begin to serve. Our scientists will be getting a look at fewer than half of those that they themselves rate as "significant for research." And this doubled number of translated

Here are two types of electronic "memories"



SMALL HEART of IBM's immense electronic computer is this plane of ferrite cores. The urgent question: Will we be able to "teach" magnetic cores like this to store away a language?



TINY PERFORATED PLATES (note pencil point) are used in RCA's memory machine. RCA says enough of these plates to fill a shoe box could recall a million bits of information.

aren't the same

TEAMWORK: Human brain controls roomful of elements in an electronic brain, IBM's 705. Tape units feed problems—some day, foreign words?—into a computing system. It needs only split seconds to weigh choices and pick the right answer.

journals will still include only one in 12 of all Russian scientific journals.

Worse, it's not just a matter of mining Russian journals. Experts say valuable material is to be found in at least 50 languages, and that there are people speaking at least 200 different languages who could use information now locked away in other tongues. Even if human translation weren't slow and expensive, for many languages besides Russian there's a frightening scarcity of trained linguists. We're trying to train them—but over the long haul, the best answer now in sight is a partnership of human translators and machines.

IT WAS World War II use of computers for a special kind of translation—devising and breaking secret codes—that led scientists to consider the possibility of a mechanical translator. For theoretically there's no reason why computers shouldn't do three things as well as—or better than—any human translator:

- Remember as much language as their builders teach them.
- Locate the words fast.
- Deliver all their stored learning—translated.

How would a translating computer actually work? First step would be to fill the computer's storage system or "memory" with a two-language dictionary—words in the "input" language and their equivalents in the "output" language, all stored in code.

In translating, each input word would be fed into the computer, which would search its coded memory for the same word. The computer then would "read"—pick out—the equivalent in the output language, decode it, and print it by teletypewriter. A simple dictionary of this sort, capable of translating a few German words into English, has been built at the University of Washington.

To see a simplified version of this operation, put a dime in a jukebox. You choose a title; that's the input word. The machine searches for the title and pulls out the corresponding record. Then the machine plays the record and you hear the output in a new language: music.

But with mechanical translators, there are these complications:

- A single word can have several forms. In Russian, for example, one stem word may have 29 different endings. Somehow, the machine must recognize the various forms of the basic word.
- A word can have several meanings. In English, the word "run," for instance, can mean 54 different things. The computer must pick the one right meaning.
- Word order is sometimes quite different in other languages. Think of the confusion if "man kills lion" were translated "lion kills man."
- Certain words in some languages don't exist in others. Russian, for example, has no words for "the" or "a." These words are vital in English: "give a man air," "give a man an air" and "give a man the air" are quite different.

Combining a machine with a human editor—who would need to know only one language—might solve some problems. The machine would print all possible meanings of doubtful words and an editor would choose the most likely one. Or an editor might go over the input copy in advance to adapt it for straight word-for-word translation.

BUT most experts believe that the best answer is to build a machine that can match everything a human translator does. Solving the multiple-ending problems would be the easiest. A machine can

be designed to separate word bases from endings, find their individual meanings, and put the two together for the correct translations.

A harder problem is to select the one right meaning of a word. But progress is being made. Research has shown that you usually understand a word's meaning in a sentence because you understand the words on either side of it. The Georgetown-IBM translating computer worked on this principle. When a direct translation was impossible, the computer cross-checked the adjacent words. The Russian word "o," for example, can mean either "about" or "of." When the machine came to "o," it was directed to check a code sign attached to the preceding word. If the code sign was 241, "o" was translated "about." If code sign 242 was found, the machine used the second English meaning—"of."

At the University of Michigan, where scientists at the Engineering Research Institute are working on a Russian-translation system, the approach is different. The method is statistical—based partly on the frequency of words in a language—as opposed to a literal linguistic approach. Yet so far the experimenters see no reason—again, in theory—why such a method couldn't eventually be used to "train" a computer to produce 90-to-95-percent-accurate translations.

Is 95-percent accuracy enough? That's the standard also achieved by some other ways of using context that have been worked out. But some experts argue that 95 percent *isn't* good enough. The most significant words in a sentence are likely to be the other five percent. In the long run, they believe, it will be quicker to learn more about the structure of language than we know now. We still have only a human's-eye view of the languages we use. We must take a new look at grammar and structure from the machine's point of view—figure out the patterns in the world's languages in order to teach them to a computer and make a translator out of it.

Once the structural pattern of two languages has been worked out, their various elements can be matched, and the machine programed to build equivalent sentences in the output language from scratch. At Massachusetts Institute of Technology, a team of four linguists and a physicist are making such a study of German. Not surprisingly, they see five to 20 years' work ahead.

Can we avoid the enormous job of pairing all important languages in this way? Yes, by developing a "master" language—either an existing one, such as English, or a new, artificial language—to which every other language system can be matched. Translations would have to be done twice—input to master, master to output—but much less basic research would be needed.

MEANWHILE there are still plenty of straightforward engineering problems for the experts to solve. One is speeding up input. At present, the input text must be copied on punch cards or tape—a real drawback when the computer rents for $30,000 a month. Some computers, however—developed to handle checks in banks—can already "read" numerals printed in special magnetic ink, and adaptation to letters is already under way. Next step will be a photoelectric scanner that can read ordinary printing—it might be hard to persuade foreigners to use magnetic ink just to please our machines.

Still further in the future are translators that will pick up a spoken statement and turn out a printed text in another language. This will require teaming a computer with a machine that will transform sounds into written symbols—an electronic stenographer. Bell Laboratory's AUDREY (Automatic Digit Recognizer) can already identify the spoken numbers from "zero" to "nine"—but only if a man says them in a clear voice. The problems are staggering because human voices and accents vary enormously. A machine that recognizes that a Georgia cracker and a British duke speak the same tongue will be a triumph of electronics.

This kind of problem isn't limited to spoken language, of course. The meaning of any sentence depends not only on the actual words but on who wrote or spoke them, when, where, why. Not until the experts figure out some way to feed this information to their machines will they have the equal of a really good human translator—the scholar who knows that a good translation of *Que sera sera* might well be "That's the way the cookie crumbles." END

You simply dial the speed you want the car to maintain, using this instrument-panel knob.

What It's Like to Drive an Auto-Pilot Car

Like it or not, the robots are slowly taking over a driver's chores. The newest one is a power-operated accelerator pedal

THE automatic auto, an intriguing if faintly ominous concept, came closer this year when the Chrysler Corporation unveiled an optional supergadget for its swanky Imperials and Chryslers. Called an "Auto-Pilot" and tabbed at about $86 extra, it is a development of a device first described in POPULAR SCIENCE several years ago ("Educated Gas Pedal Keeps the Cops Away," Jan. '54).

Actually, the device is a power-operated accelerator pedal. This fact alone has been enough to distress some car critics, who argue that drivers are being increasingly engineered out of a decent sense of participation in the new cars. The Auto-

SNUGGLED on the 1958 Imperial between a vacuum tank and the power brake, the Auto-Pilot fits on the left side of the engine compartment. Its motor runs only intermittently.

You become increasingly aware of the sensitive tasks

Pilot has also hoisted the eyebrows of a few safety experts. Here the contention has been that, with literally nothing to do except steer and ruminate, a driver may fall victim to hypnotic goof-offs.

Such judgments appear to be academic. This writer recently made a 4,000-mile cross-country run in an Auto-Pilot car, and ended up with these conclusions:

- It is a real comfort on a hard run.
- For psychological reasons, it is not an incitement to dozing.
- It can be used on many, but by no means all, intercity roads; and
- It gives some fascinating insights into unconscious driving habits.

What it is. On the instrument panel there's a pushbutton and a knob that can be turned to calibrations from 30 to 80. Under the hood there's a shiny hunk of mechanism, smaller than a breadbox, that houses a reversible electric motor, a flyball governor, and associated electrical gadgetry. A flexible shaft resembling a speedometer cable feeds in car-speed information; a rod leading to the carburetor linkage executes commands to the throttle.

What it does. This is not easy to explain to women and the mechanically innocent. Not that the gadget is particularly complex; it's just that it offers two different though related services. In function No. 1 it is a speed minder—a mechanical conscience that urges you, by increased accelerator resistance, to stay under the speed it is set at. It doesn't actually prevent you from speeding, though; you can (while passing, say) readily tromp past the increased resistance.

In function No. 2 the device is a speed maintainer. Its motor depresses or releases the accelerator as needed to hold the set speed up hill or down, whether your foot is on the gas or not. You bring the car up to the speed the knob is set for and then touch the latching button. The car then eerily continues at that speed until it runs out of gas—or until you touch the brake pedal. This instantly unlatches it, returning you to conventional operation. In effect it is a robot that constantly compares an ideal speed (the knob setting) with the car's actual speed. Whenever the two begin to differ, the throttle is corrected and the speeds recompared.

Its best is very good. On the 60-m.p.h. New Jersey turnpike the Auto-Pilot showed off theatrically; it managed the throttle for 76 miles in an elapsed time of 76 minutes and 13 seconds. Even that 13-second error—less than half of one percent—wasn't really the gadget's fault. Once it had to be unlatched for a moment because of a bind in traffic, and another time for a brief debate on the tactfulness of overtaking a police car.

In hilly country, as in much of West Virginia, this remarkable precision falls off. Average speed still is close to the set one, because hill effects are usually transient, and tend to cancel. But temporary variations of three or four m.p.h. above and below the setting aren't uncommon.

The reason lies, of course, in the limitations of the throttle as a speed corrective. Downhill, the most the little robot can do is take its electromechanical foot completely off the accelerator. If the grade is so steep that that isn't enough, the car necessarily goes faster.

Uphill, the situation is slightly different. Chrysler's big engine has ample moxie to hold speed on any normal highway grade, given a moment or two to roll up its sleeves. The trouble is that the Auto-Pilot doesn't know a hill is coming. It gets word only on how fast the car is going *now;* there's no anticipation. So the robot acts only when the upgrade has already begun to slow the car. It feeds a little more gas; and when in the case of a sudden hill that isn't enough, it piles on more and more power. Soon the big

How electric motor controls gas-pedal position

THE actual mechanism of the Auto-Pilot is both more compact and more complex than this simplified diagram suggests. Automatic control is as follows:

1. The desired speed is set by the speed-adjustment knob. This changes the force exerted by the governor spring.
2. At dialed speed, the latching button is pressed. An electromagnet draws down a latch that rigidly joins two control arms. One arm is positioned by a reversible motor and the other is linked to the throttle.

engine is laying into it potently and the speed comes back up.

Your clever foot. Driving a few thousand miles with this robot will give you increased awareness of the sensitive, constantly corrected tasks that your right foot has been performing all these years. The most obvious one is this attack on a hill. Quite automatically, an experienced driver's accelerator foot feeds a little extra speed at the approach of a hill. Even if you don't actually crack on a few extra miles an hour (which you usually do), that foot is alerted to press down at a quickly increased rate the moment the hill load comes on the engine.

Topping a rise. A more subtle example of delicate human throttle handling comes at the top of a hill. In South Carolina we noticed that, as you go up and over a fairly steep rise with the robot locked on, there is a strong impression of something slightly wrong. The Auto-Pilot seems to feed more gas as you near the top; you seem to crest the hill going faster than on the middle slope.

This is an illusion, as the speedometer reveals. At first it is a puzzler: The robot is clearly whisking you over the top, but the needle shows no (or almost no) overshoot. Then it dawns on you: It feels slightly wrong because it's not the way you drive yourself. Just as the Auto-Pilot didn't know a grade was coming, now it doesn't know that near the top of a hill there is a point where your sight distance shortens rapidly. Managing the accelerator yourself, you automatically feather back, throwing away a little speed to compensate for the reduced distance you can see. The robot, knowing nothing of this, simply whisks the car up and over at a constant rate.

This hilltop quirk of the Auto-Pilot (more accurately, of sight geometry) doesn't amount to a hazard of consequence. If the hill-cresting threatens to become too brisk, you simply tap the brake and unlatch, or else just back off the speed knob.

Around the bend. On a cross-country run you inevitably notice how state highway departments compare, and particularly how they throw you their curves. On some roads the curves come up fair and square, keeping above a minimum and uniform radius of curvature. Others, though, are sneaky: They mix up their offerings deceptively, tossing in an occasional spitter that tightens up wickedly.

The Auto-Pilot dramatizes these differences. It works fine on some curvy roads, mainly the newer and more lavishly designed ones. On others, though, like the secondary highways in Georgia and Alabama, it's more trouble than not, since you are incessantly unlatching. The problem is this: How big a spread is there between cruising speed for the curves and that for the straights? On a road where the 60-m.p.h. straights are irregularly interrupted by 30- or even 25-m.p.h. curves, you don't use the Auto-Pilot.

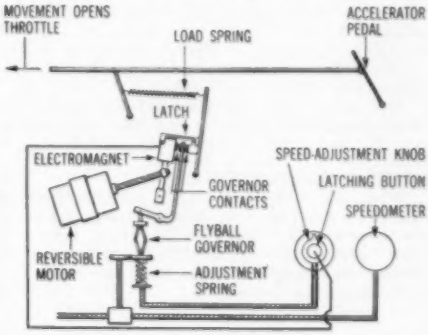
Those top speeds. Unexpectedly, you tend to drive a little slower with the Auto-

[*Continued on page 248*]

3. As car speed deviates from the set speed, contacts on a governor-controlled center lever touch one or the other arm. This energizes the motor in the direction that will move both arms to open or close the throttle. When car speed is corrected and stabilized, the governor contacts are centered.

For clarity, part of the throttle-opening linkage is omitted here, as is the circuit that unlatches the arms if the brake pedal is touched.

In its speed-warning function, the device operates with the latch "ajar." This does not open the throttle automatically, but does interpose extra spring loading on the accelerator above dialed speed.



New Radio Steals Its Power from the Air

Nearby station can furnish power . . . to receive a distant station

Invention of "telepower" will give broadcast waves striking new jobs to do

FOR the past three years a radio in the attic of a suburban Washington home has been driving a 12" loudspeaker 24 hours a day without using house current, batteries or solar energy. It gets free power from the air waves.

There are two independent circuits in the receiver: one to pick up the signal you hear, the other to extract from the atmosphere the tiny amount of power required by the receiver's transistors. The power circuit captures some of the electrical energy coming from radio or TV broadcasting sta-

A TELEPOWER RECEIVER YOU CAN BUILD

HERE is a circuit to start you on your own experiments with telepower. It is designed for headphone operation on the broadcast band and gets its operating power from a local broadcast transmitter.

Circuit No. 1 on the diagram is the radio receiver using a crystal diode, D1, for the detector and a PNP transistor as an amplifier. The antenna is coupled to the tuning coil, L1, by three turns of insulated wire wound on the top end of the coil. This same wire continues to circuit No. 2, the telepower circuit, where it is coupled to a second tuning coil, L2, through a trimmer condenser, C2.

The diode, D2, rectifies the incoming radio-frequency energy, and the resulting DC is stored in condenser C3 which serves as the battery for the transistor amplifier in circuit No. 1.

When the receiver is wired, connect the antenna, ground and headphones. Antenna should be about 50 feet long, and high above the ground. Headphones should be magnetic type with at least 2,000-ohm impedance.

To adjust the receiver:

1. Temporarily connect 1½-volt flashlight battery across C3 with positive terminal to the ground.
2. Tune circuit No. 1 by turning the threaded shaft in L1 until the strongest station is heard.
3. Leave set tuned to the strongest station and remove the battery.
4. With the headset still on, adjust C2 and L2 until you hear the signal loudest. A voltmeter (three-volt scale) connected across C3 will give you a more accurate indication of peak-power adjustment.

This completes the adjustment of the telepower part of the circuit. No future adjustment of this circuit will be needed unless the antenna or location is changed.

5. Now complete the adjustment of circuit No. 1 by screwing the slug in L1 all the way in and adjusting C1 to bring in the lowest-frequency station on the dial. This adjustment is to assure maximum coverage of the broadcast band.

To get any AM broadcast within range of your receiver, after the initial adjust-

tions, changes it to DC and stores it in a condenser, which then acts as a battery. Up to eight volts has been maintained across the condenser with the power circuit tuned to a nearby TV transmitter. While this set can tune in the program from any AM broadcasting station within range, it gets the operating voltages for its transistors from the local TV station.

This is a deluxe version of an invention by Lloyd R. Crump, an electronics specialist at the Army's Diamond Fuze Laboratories. He has coined the word "telepower" for his patented principle of powering electrical devices with energy captured from the air.

To demonstrate the practicality of his idea, Crump has designed the simple broadcast receiver described below.

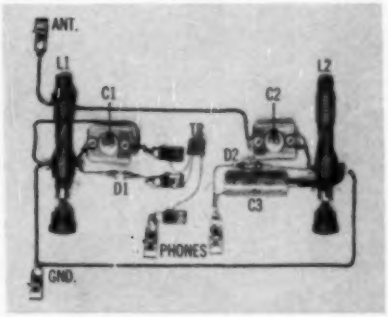
You can easily build it yourself from standard radio parts, or you can get a kit of parts from the inventor for $6.50. (L. R. Crump, 12108 Atherton Drive, Silver Spring, Md.)

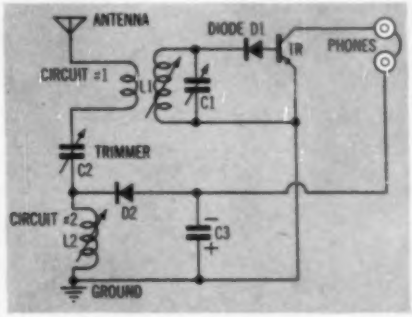
But entertainment is only a sidelight to the more important uses to which the invention can be put. The principle can also be used to power miniature transmitters. This promises a host of valuable applications. Since there is no power supply to deteriorate with age, such a transmitter could be planted as a location marker that would send out its telltale signal every time it was excited by the transmitters in passing airplanes or ships. It could be concealed as a listening device that an operator at a remote location could energize at any time and then listen to. The cloak-and-dagger possibilities are obvious.

As a remote-switching device that would be continuously alert, it could set off explosives, turn beacon lights or warning signals off or on, or operate a garage door's opening apparatus.

Fixed-tuned receivers powered by a central transmitter could call emergency crews, act as civil-defense alarms, or be used as office intercoms.

This whole field of inquiry is brand new. The most valuable applications may come from experimenters and hobbyists working with the basic principle. Further research, coupled with development of special circuit components, will, Crump says, extend the horizons far beyond present applications.—*Hubert Luckett.*





ment is finished, all you have to do is screw the slug in or out of L1.

The antenna needed will vary with station power, distance and other factors. As a general rule the longer and higher, the better. But this set has operated at overload volume with only a three-foot wire for an antenna, one mile from a small (500-watt) station.

Parts List:

L1, L2: High-Q, ferrite core, broadcast-band antenna coil with knobs

D1, D2: IN34A crystal diodes

TR: PNP (Ck 721 or 2N77) transistor

C1, C2: 5 180-mfd. trimmer condensers

C3: 10-mfd. low-voltage electrolytic condenser

Headphones: 2,000-ohm magnetic

Our First 5,000-Mile

Missile Is Ready Now

Are we overlooking a bet in the Snark, our NON-ballistic intercontinental weapon? Here are facts on its strengths and weaknesses

By Wesley S. Griswold

WHILE all the talk goes on about whether or not we're behind the Russians in long-range striking power, one often-overlooked fact is worth remembering: We already have a guided missile that can carry a big hydrogen bomb 5,000 miles and drop it smack on target.

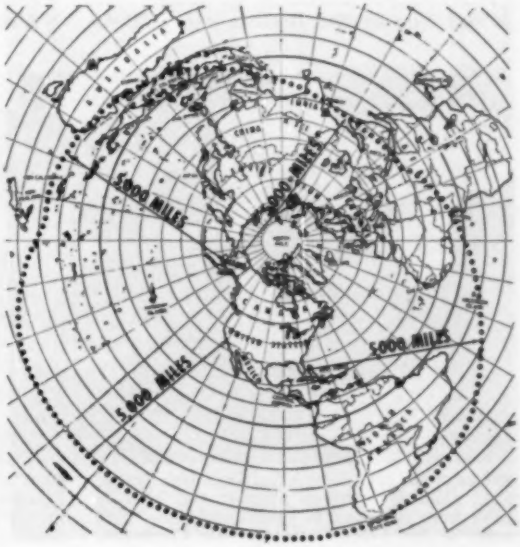
The Snark, a 69-foot, jet-powered, winged weapon with a self-contained guidance system that cannot be jammed, first proved that it could do this awesomely difficult job last October 31. With a dummy warhead in its sharp nose, a Snark on that day thundered up from Cape Canaveral, Fla., leaving a slim vapor trail to mark its swift climb into the southeastern sky. A few hours later, it dove at supersonic speed to its intended goal—a 5,000-mile-distant point in the Atlantic Ocean near Ascension Island, between Brazil and Africa.

Within five weeks another Snark performed the same outstanding feat, and the Air Force told the world that the U. S. possessed a missile of intercontinental range and "unprecedented accuracy." It added that the Snark up to then had made more than 50 successful flights. Totaling something like 75,000 miles, they gave evidence of a seasoned weapon, with developmental kinks ironed out.

Yet, at this writing, only a few score Snarks had been ordered from Northrop Aircraft, Inc., of Hawthorne, Cal., which developed the weapon and has been building test models of it for the past six years. The Air Force has set up only one Snark

A Snark in flight—and possible destinations

Head-on view, left, shows Snark's takeoff with twin rocket boosters. Always ready to fire, missile can be let fly on a moment's notice. Suggesting a giant stinging insect in appearance, it is designed to carry warhead of any type, including hydrogen bomb. Launching platform in photo will be replaced by a mobile launcher in the field. Test Snarks like this one are painted red, standard color for experimental missiles and planes; operational Snarks will be silver, with AF markings in red, white and blue. Map at right illustrates almost-worldwide area (within dotted line) to which Snarks could fly from continental U.S. territory alone. Only Australia, part of Africa, and southernmost Asia would be beyond missiles' 5,000-mile range. First actual Snark base, at northeastern tip of U. S. in Maine, will be within reach of all of Europe and the northern part of Asia.



squadron, assigned to a base at Presque Isle, Me., but still in training.

With not even a modest number of intermediate-range ballistic missiles yet in readiness at bases with trained crews—and with our intercontinental ballistic missiles still further away—why hasn't the Snark been rushed into mass production to fill the gap meanwhile? And why does Snark still lag, if those responsible for our missile program haven't advanced its production schedule by the time this is read?

The answer is that not all top Air Force officials agree on the merit of the Snark.

Those officers who are rooting for it make these points:

- The Snark, truly our first intercontinental missile, is way beyond the trial-and-error stage, which our IRBMs and ICBMs will be struggling through for many months to come.
- It is already being produced in greater numbers than any other long-range U. S. missile. All-out production of it, therefore, could be achieved much faster than in the case of the others.
- Its guidance system, of critical importance to any intercontinental missile, has repeatedly endured launching shock without damage and proved itself remarkably accurate.
- It can be kept fully fueled and ready for immediate takeoff at all times. This is not true of the IRBMs and ICBMs that use liquid oxygen, which evaporates rapidly on standing. The Snark uses the same jet fuel that planes do.
- It is highly mobile. Snarks can be airlifted in a day or two to any part of the world where a C-124 transport plane can land. Once there, they can be placed on portable launchers and fired from the handiest flat patch of ground. Then the launchers and birds can promptly be moved to a new, safe location for the next firing. IRBMs and ICBMs, with launching platforms rooted in concrete, cannot be shifted around and thus cannot dodge return fire.

Critics of the Snark say:

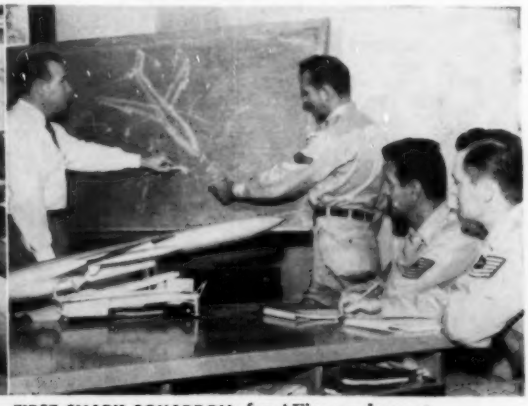
- It flies too low and too slow—making it vulnerable to conventional AA missiles, and even to supersonic interceptor planes. It would take a Snark eight hours to fly from Cape Canaveral to Moscow. A Russian ICBM could whiz from Moscow to Cape Canaveral in 20 minutes.
- The money it would take to produce many squadrons of Snarks might better be used to increase future stockpiles of IRBMs and ICBMs.

Snark advocates reply:

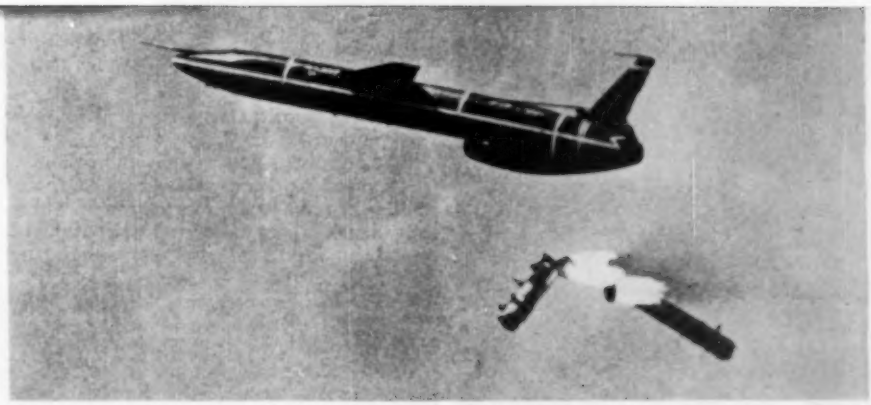
"Nobody's saying that the Snark can take the place of an ICBM, but we've *got* the Snark, and we won't have the ICBM for a long time yet. Wouldn't it be wise to have lots of Snarks to strengthen our long-range striking force, while we're waiting for the ballistic missiles?"

And a Snark, they maintain, isn't so

PRODUCTION LINE hatches Snarks in Hawthorne, Cal., plant of Northrop Aircraft, Inc. Missiles have been assigned to operational duty with units of Air Force's Strategic Air Command.



FIRST SNARK SQUADRON, for AF's new base at Presque Isle, Me., gets preliminary technical instruction. On table in foreground is model of Snark poised for flight on mobile launcher.



After launching, Snark drops spent boosters, and turbojet propels it at near-sonic speed.

easy to detect and shoot down. First, it can slip through electronic nets easily. Clean-lined, it's free of most of the "corners"—right-angled joints of surfaces—that catch and reflect search-radar pulses. Even the most sophisticated radars can't find a Snark until it's near enough to do ruinous damage. (Test Snarks, soaring over the Atlantic range, have to be equipped with special electronic beams so that our own radars can find and follow them.)

To enemy defensive missiles that are infra-red seekers, the Snark presents only one small target—its single engine—in contrast to our biggest jet bomber's eight.

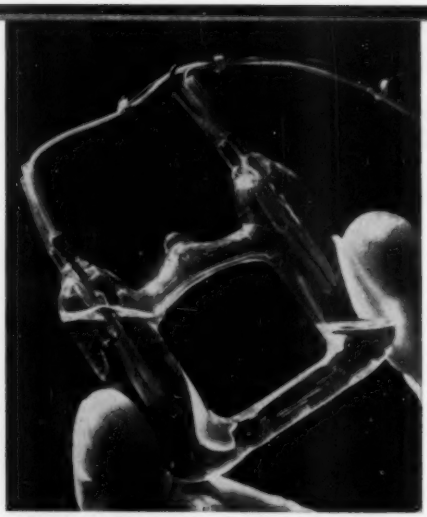
Snarks can be equipped with electronic countermeasures, devices that so confuse enemy radars that they think a whole squadron is approaching for each actual missile. This leads to wild antiaircraft fire and a fruitless squandering of fighter strength.

A Snark's flight can be programed to end with a low-level approach to its target. It can come in so close to the ground that it is practically immune to AA fire, lost to enemy radars, and exceedingly hard for defending fighters to pounce upon without smacking into the earth.

Though the initials of its official name, SM-62, stand for "Strategic Missile," the Snark looks like a plane. It is, in effect, a pilotless bomber, 1/10 the size of a B-52 and in large quantities about 1/20 as expensive. It is comparable to a modern fighter in length, wingspread (42 feet) and height (14½ feet to the tip of its narrow tail). With warhead and fuel

BY AIR, Snarks can be rushed to any launching point in world. Above, missile's fuselage rolls into C-124 Globemaster. Wings and tail go next. Another C-124 carries the mobile launcher.

MOBILE LAUNCHER, with Snark in place, rolls on 16 tires. Tractor or half-track tows it to place of firing—which may be any flat, open field or clearing, a few missile-lengths long.



WITH ACCELEROMETERS like this, by movements of current-carrying liquid around tungsten electrodes in glass tube, guidance system measures changes of velocity and direction in flight.

aboard, it weighs about 20 tons. Underwing auxiliary fuel tanks, with an automatic transfer system to keep the Snark on an even keel as it burns up its fuel, can stretch its range to 6,000 miles if necessary.

In flight, the Snark is powered by a single J-57 turbojet engine, with 10,000-lb. thrust. The missile's top speed is around 650 m.p.h., and it can fly at heights ranging all the way from just above the treetops to altitudes over 50,000 feet.

Two solid-fuel rocket boosters developing more than 100,000 pounds of thrust apiece, attached to the Snark's sides, launch it without need of a takeoff run. First, by remote control, the missile's engine is throttled up to 95 percent of full power. Then, while electrical and fuel lines drop away, the rocket boosters ignite with such violence that within two missile lengths the Snark is traveling at full speed. In a few seconds, the spent boosters are shed and the missile is off on an intercontinental mission.

The Snark is now wholly under the control of its extraordinary guidance system, which combines inertial guidance and star tracking, and functions without help from radio or radar. Since the system neither broadcasts electronic impulses nor receives any, it never gives away its presence in the limitless sky. No enemy signals can seek out and befuddle it. And it is immune to interference from electrical storms, sunspots and the earth's magnetism.

In principle, here is how it works:

A memory drum in an airborne computer contains exact information on where the Snark ought to be, and what it ought to do, at any particular moment during the flight.

A team of gyroscopes and accelerometers tells the computer where the Snark actually is, and what it is actually doing. That team gets intermittent help from a telescopic eye—which automatically sights on one or more predetermined stars, whenever clouds are not in the way, to double-check the Snark's position.

If these instruments' reports differ from the program on the computer's memory drum, command signals flash to an automatic pilot. With flight controls, it steers the Snark back on course.

Before a Snark roars off on a mission, men must perform precise aeronautical and astronomical calculations to make up its program. These instructions are coded, and fed into the computer's memory drum on magnetic tape or punched paper tape. Also, the memory drum is fed sets of alternative commands to get the Snark out of trouble and back on schedule, in case it runs into turbulence or adverse winds.

All the information supplied to the memory drum is keyed to a rigid time schedule, kept by an extremely accurate clock. This clock also automatically makes corrections to take account of the rotation of the earth.

The gyroscopes are fastened to a little platform in a box, and the platform is gimbal-mounted to keep it independent of the Snark's body. At the start of a Snark flight, the gyro platform is perfectly level; a perpendicular line down through its middle would pass through the center of the earth. During flight, whenever the Snark's movements threaten to tilt the platform, the gyroscopes resist the tilting and persistently restore the platform to its original position.

The accelerometers are mounted on the same platform. They measure every movement, as acceleration in that direction, and flash the measurement to integrators in the computer. The integrators convert acceleration to velocity, then to distance traveled.

[*Continued on page 254*]

Tip to planners-ahead:

We Took a Houseboat Vacation

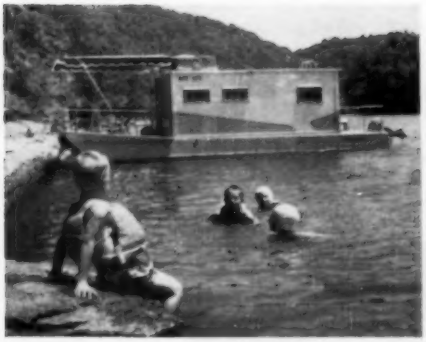
By George Laycock

OUR houseboating vacation began when we discovered that now you can *rent* one of these spacious barges. On the Ohio River, not far from home, two new houseboats were available at $110 a week each.

We chose the River Queen, a steel-hulled boat 24 feet long by nine feet wide. Her cabin had a picture window, a fully equipped kitchen, two bunk beds, clothes closet and "head" (lavatory). Controls were inside for the captain's comfort in

Tying life jackets on Steve, 6, and the two older kids whenever they came on deck ended our main concern. They tied jackets on toy animals to get even

Even our youngest crew member took tricks at the wheel when traffic was light. Propelled at a lazy five or six m.p.h. by its 25-hp. inboard, the River Queen proved highly maneuverable despite its ungainly shape. Simple charts showed the channel and helped us plan rest stops



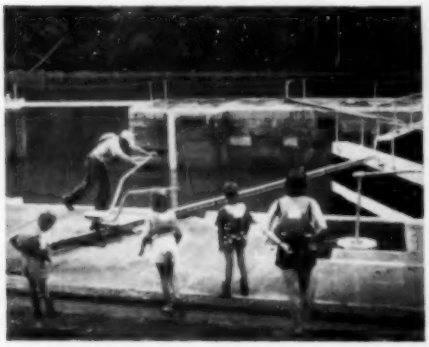
In the middle of the day we'd stop for a swim in the Kentucky River. The boat's steel hull made it safe to tie up so long as there was enough water to float

bad weather. You could enjoy the sun on the upper deck or shade under the canopy over the foredeck.

For 10 days we cruised on the broad Ohio and the narrow, twisting Kentucky River. We covered 450 miles, moving lazily along, by day only, five or six miles an hour. We rounded one bend after another, never looking at the same landscape twice. At night we stopped wherever we happened to be and tied up to a nearby tree or dock.

There was no worry about advance reservations, no search for restaurants, no highway traffic to fight. We fished when we wanted to, swam when we liked. The

[*Continued on page 236*]



We locked through five dams on the Ohio, seven on the Kentucky. All the latter's dams, like this one, still have hand-operated gates. Some are 115 years old

Early American history was made on and alongside the Ohio and Kentucky. Washington, Boone, Johnny Appleseed and Audubon knew the rivers well

From the labs...

Tires That Ride Softer But Last Longer

By Robert Gorman

FRAMED BY LOW-PROFILE TIRE are three other experimental types for which special advantages are claimed: butyl (soft ride), polyurethane (abrasion resistance), wire cord (high mileage).

What Does a New Tire Need?

Before any new material for tires can go into production, it must prove itself under a wide range of operating conditions. Some features can only be had by sacrificing others; a single defect may offset a dozen virtues.

What do tire men test for? The items below, taken from a 56-point checklist used by U. S. Rubber Co., cover some important features.

Before a tire is even tested, material and production costs are carefully figured, and stylists must approve its appearance. They rate it for massiveness, for harmony with the outlines of cars on which it will be used, for durability of color and decorations.

A change as small as shaving a half-inch from a white-sidewall band, they say, can make or break a tire. Or a good tread may be dropped if it looks too hefty from the side.

High-speed pikes and heavier, faster, lower cars make tough going for tire manufacturers. What are they doing to catch up?

"Now here, you see," said the Queen, "it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

—Lewis Carroll
Through the Looking-Glass

TIRE companies are running extra hard these days, trying to beat the Alice-in-Wonderland trend of the last half dozen years. For in spite of the substantial improvements they have made in this period, their product has barely kept pace with speeded-up requirements.

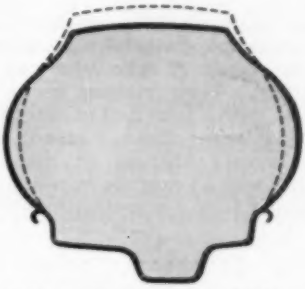
The combination of faster roads and heavier, higher-powered, lower-slung, softer-sprung, power-steered and power-braked cars has whittled away the improvements the tire makers have been building into their product. Now major technological breakthroughs are needed, and the search is on in earnest. The laboratories hold out hope for tires that will last longer, give you a softer, quieter ride, improve car handling, offer more safety at higher speeds.

Tomorrow's tires can be fairly well previewed. Research is centering around the creation of polymers—synthetic rubbers—that promise better wear and more comfort. Probable new ways of building tread and carcass aim in the same direction. If Detroit has its way, your fifth tire will soon disappear (see box, p. 120) and the remaining four will shrink more than they have already.

But: Partly from fear of tipping company plans, most tire men are tight-lipped about their laboratory projects and tend to emphasize weaknesses of new materials, not virtues.

A more important reason for cautious forecasts: Tire advances usually depend less on what rubber experts know than on what car designers want. Most new tires are joint developments by tire and auto companies. The differing interests of the two camps sometimes lead to heel-dragging.

A case in point may be shallower tires. Most rubber companies take a dim view of the so-called "low-profile" tire introduced last year as standard equipment on the Cadillac Eldorado Brougham's 15-inch wheels. U. S. Rubber Co., which makes the tire for Cadillac, hails the squatter, more elliptical tire as the forerunner of a trend.



LOW-PROFILE TIRE, shown by solid line, is shallower in cross-section than standard tire (broken line) but handles better, takes greater load, and can be run at higher speed.

Fashion considerations would seem to support this view. To keep building ever-lower, heavier, longer cars involves new drawing-board concepts that must face mechanical facts of life.

For example, cars can be made lower by reducing wheel-rim diameters—but

PERFORMANCE:
Evenness of tread wear
Antiskid mileage
Traction
Resistance to cracks and cuts
Ply or carcass separation
Steering effort
Bead failure
Sidewall scuff resistance

SAFETY:
Directional skid resistance
Heat build-up and strength
Blowout resistance
Stability
Wind drift
Cornering stability
Steering-wheel response
Fabric breaks

COMFORT:
Cornering noise (squeal)
Braking noise
Expansion-joint noise
Retention of stones
Car-radio interference
Thump
Riding softness (deflection rate)
Harshness

smaller wheels force a reduction in braking area, so safety considerations limit this approach.

Size, however, is just one of the advantages claimed for the new tires. Technically, the term "low-profile" describes any tire that, seen in cross-section, is wider than it is high. A major reason for lowering a tire's height-to-width ratio is that, for any given diameter, a wider tire will carry a greater load. Moreover, the squatter cross-section is obtained in part by reducing the angle at which body cords cross the centerline of the tread. Though this makes the ride slightly harsher, it raises top-speed capacity and improves cornering stability and steering-wheel response.

The tire sounds good—yet only its parents act proud of the new baby. Most other tire people shrug off the low profile as an innovation of little value and even less future. Their reasons are chiefly economic, with a faint hint of sour grapes.

By and large, rubber companies welcome Detroit's changes in tire styles about the way an average man welcomes a long visit from his mother-in-law: It's a disruption you can live with, but would rather avoid.

Tire plants can easily build any tire to a set of specs. But to supply the replacement market with a choice of four qualities, rayon or nylon cords, black or white sidewalls, regular or snow treads may mean as many as two dozen varieties *for each new size*. It's a jumbo production and merchandising headache.

Many tire men also say that tires *shouldn't* get smaller than they are, especially if speeds continue to rise. For, other things being equal, larger tires run cooler, wear longer, and handle better. By this argument, the cord angle that gives low profile superior speed and stability can be—has been—used to better advantage in tires of conventional size.

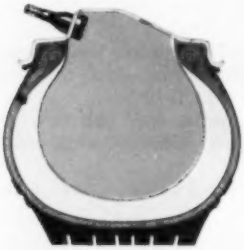
New rubber compounds might meet some of Detroit's objectives and the tire industry's problems.

Butyl—or a similar polymer—tops the likely comers. People who have ridden on butyls agree they are sensationally soft and quiet. They are stable, have good skid resistance, are virtually free of braking or cornering squeal.

Tomorrow's Substitute for Your Spare Tire

Car designers have designs on your fifth wheel.

For years, it's been a thorn in the side of stylists who have revolutionized the forward look but couldn't look backward so long as a spare tire had to make its home in the trunk.



FIRESTONE non-pneumatic is a ring of rubber on a thin wheel. Bolted alongside flat (on the same studs), it will carry you for miles at moderate speeds. If gas-tank top were recessed, it could be stored under the trunk mat.

Now, a few station wagons have floated free of the past, riding on Goodyear's "Captive Air," or Firestone's "Safety Airlock." Though they differ in details, each is a dual-diaphragm tire having a smaller, separately inflated tire inside the regular one. If the outer tire is punctured, you can ride safely on the inner air to the next gas station or a hundred miles beyond.

Their big advantage aside from the

Another quality that has won butyl many friends and influenced Government contracts is its tightly knit molecular structure. Chemists call this property "saturation." With it, butyl tires don't deteriorate when exposed to air or California smog.

Seeking a military tire that could be stockpiled indefinitely without weather damage, the Army backed butyl research. Last summer it announced a success: development of heavy-duty truck tires.

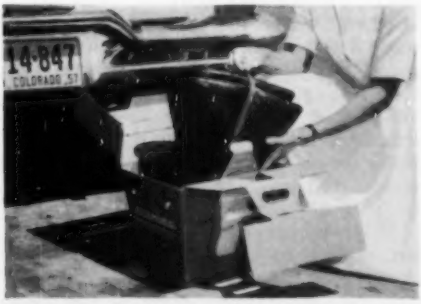
Butyl, the standard inner-tube rubber for some years, was invented in 1937 by two scientists of what is now the Esso Research and Engineering Co. The coming of tubeless tires prompted Esso to test butyl as a tire material.

After a poor start, this synthetic made of two oil-refinery gases has come a long way. Early butyl tires fell apart at speeds over 40 miles an hour. They had poor tread life and made steering difficult. Butyl-tired cars accelerated feebly, consumed more gas, and had poor braking traction on ice or packed snow.

Now, say Esso scientists, they have minimized these difficulties, and have beat down the cost of commercial production. But considerably more work—or a change in automatic transmissions—may be needed to overcome a major drawback: for butyl's outstanding ability to cushion noise and vibration results from the fact

STEEL CORDS, used as breaker strips between the tread and carcass of Michelin-X tires, increase tread wear two to three times. They also improve handling—but only on some cars.

GOODRICH fold-up is just a roadable inner tube fitted to its own wheel. Deflated, it could be squeezed into smaller trunk space. You'd carry a pressure cartridge to inflate the tire when you mounted it in place of a flat.



GATES wheelless spare and its cartridge inflator would fit anywhere, so it solves all space problems, except where to carry a flat. However, lady drivers might have difficulty getting flat tire off—and spare tire on—the same wheel.

modishness of getting rid of the spare is that you don't have to change a tire in a dangerous place; their main hitch (aside from high cost) is that once fifth-wheel space is designed out of a car, people who want a spare will have no place to put one.

Hoping to make everybody happy, some tire companies have dreamed up a variety of "crutch" tires that take little space yet serve as emergency spares. Three are shown here, others are reported on the way. With any of them you'd have to carry a jack.

that it absorbs more energy than conventional tire compounds. This, in turn, has three less desirable results:

- You need slightly more gas to move butyl tires.
- Their capacity to meet speed requirements of the future may be limited.
- Butyls have greater "rolling resistance"—particularly noticeable when the tires are cold. "Until they warm up," one engineer put it, "you think you're driving with the anchor out."

Nevertheless, drivers will soon have a chance to decide for themselves whether a really velvety ride justifies these inconveniences. An estimated 25,000 butyls have already been made in several pilot-plants, and some of these have been released — unannounced. A step-up in production is expected soon.

A large-scale swing to butyl tires, however, isn't in the cards. There isn't enough of the polymer being made, and it can't be produced in the synthetic-rubber plants that now supply the tire industry. And it is likely that rubber-company chemists will come up with rival polymers with at least some of butyl's advantages. One of these may have been used in a low-squeal tire that was briefly unveiled last December by Firestone. Top engineers called the tire and its unidentified rubber "experimental," but strongly hinted that it would be commercial within "a couple of years."

BUTYL TIRES for military vehicles, built by Mansfield Tire and Rubber Co., have been tested and okayed by Army Ordnance.

Polyurethane, long used in foam cushions and shoe soles, is another rubber undergoing active study in the tire labs. The reason? Polyurethane is the most abrasion-resistant tire material turned up to date. This is the rubber that has given rise to hopeful speculations about 100,000-mile tires.

Like other of the harder compounds, polyurethane rides a little rougher and is not yet too highly rated on traction and skid resistance. But its super-durability opens up attractive possibilities:

Treads. They could be made thinner to combine greater high-speed safety with, say, twice the mileage of present tires. And since lighter tires would reduce a car's unsprung weight, they could be expected to improve its riding and handling qualities.

As of now, however, polyurethane's debut as a tire material must be listed as doubtful. The stumbling block is that it can't—so far—be securely bonded to a carcass. Experimental tires have been made entirely of polyurethane to get around the bonding problem, but these aren't considered satisfactory prototypes.

The outlook, of course, could change overnight—if a satisfactory method is found for bonding the dissimilar polymers of tread and carcass. Growing concern for safety and tread life will continue to spur the search, but chemists aren't bubbling with hope.

Cords and construction. One method of extending tread life is by compounding rubbers for greater abrasion resistance. A parallel approach consists of stiffening the tread area to reduce effective abrasion.

There are many possible tread stiffeners, but of those now available, few have the all-around advantages of steel-wire cords. In strength, wire cords far outclass fabrics and make a tire practically immune to blowout. Fewer plies are needed, which means that tires run cooler and with less chance of failure. It's not surprising, therefore, that truck-tire lines are adopting some wire-cord models.

Can these virtues be carried over to passenger tires? American experts say the prospects are remote. But if you're impatient to drive on wire cords, you may find your tire size in a line of French imports available right now. This Michelin tire, known as the "X-type," has three layers of woven-steel cord between the tread and carcass.

Fabric cords are used in the body, but instead of being cross-woven, they are formed like an arch, with each cord running from bead to bead. Though this makes the wall easier prey to curb-scuffs and bruises, the unstretchable tread of

[*Continued on page 244*]

The writer, pale but resolute, is shown here with Major Herbert Stallings, pilot of the plane in which the "weightless" flight was made

I Was Weightless for 39 Seconds

How does it feel to float in space? PS reporter acts as a guinea pig—and shares with you his extraordinary sensations

By Eliot Tozer

YOU'RE in for a thrill if you ever take a ride in a spaceship. You'll feel as though you've just reached the top of a roller coaster—and you'll hang there for the rest of the trip through space. It will be like a pleasant dream without sleep. You'll barely hear the monotonous click and hum of the spaceship's electronic gear. You may wish you never had to come back.

Or you may be as sick as a dog. You may feel hot, feverish, then shudder with cold, struggle to draw each breath.

How come?

You'll be weightless. When your spaceship rockets up to orbital velocity, canceling out the earth's gravitational field, the normal reassuring pull of gravity will give way. The sensors in your inner ear, your skin, muscles, and connective tissue will go limp and you'll enter a strange and dream-like state of mild exhilaration —or get sick.

All this the doctors told me at the School of Aviation Medicine, Randolph Air Force Base, Texas, where they are studying the effects of zero gravity on human behavior and physiology. Knowledge gained from these experiments will be of immense value in designing the manned earth satellites and space vehicles of the future.

POPULAR SCIENCE had sent me down to Randolph to join the little group of men —there are not very many—who have been truly weightless and record my sensations while in that strange condition.

Now the medics were giving me a thorough physical examination. Later, after a pressure-chamber "flight" to 25,000 feet, I would strap myself into the back seat of an F-94C Starfire and climb about five miles above south Texas. There, with Major Herbert Stallings at the con-

trols, I would ride the parabolic arc that produces the longest periods of zero gravity attainable—so far. As an ex-Navy pilot, I had done a good bit of flying, but now I was on the threshold of a totally new experience.

I got my final briefing from Dr. Siegfried Gerathewohl, probably the world's foremost expert on weightlessness. He said, "Major Stallings will dive to pick up speed. At about 450 knots, he'll pull up into a 70-degree climb. Then, with the afterburner on, he'll ease forward on the stick. As he continues to move the stick slowly forward, you'll gradually change direction from almost straight up, to level flight, to almost straight down. As you do, the centrifugal force will throw you up and away from the seat."

"But isn't that negative Gs?" I asked, "as in an outside loop?"

"No, because Herb will fly the airplane so that the centrifugal force always just counteracts the pull of gravity. With gravity canceled out, you'll be weightless from the time you start your climb until you pull out at the end of the arc."

"How does Herb know we're exactly at zero gravity?"

"In our first experiments, we used a standard aircraft G meter," said Dr. Gerathewohl. "It wasn't accurate enough. So we hung a golf ball on a string." He grinned. "When it floats, you're weightless."

Herb helped me adjust the straps on my crash helmet. "You won't be weightless long," he said. "The record in an F-94 is 43 seconds. We can't get up enough speed to hang there longer than that."

We climbed into the jeep and headed slowly for the flight line. On the ground, this jet-jockey was an impressively cautious driver.

"What about the other experiments I've read about?" I said. "I've seen pictures of people floating around in the back end of a DC-3 and floating in water."

Dr. Gerathewohl looked pained. "Anyone knows," he said, "that a DC-3 can't get up enough speed to fly a parabolic arc for more than two or three seconds. As for the water-tank tests, these are valuable—up to a point."

We parked beside the hangar and Herb went off to file our flight plan. Dr. Gerathewohl said, "You see, your body has different kinds of gravity sensors. Most important are the otoliths in your inner ear. Basically, they measure the pull of gravity."

I jotted down "otolith—pull of gravity."

"You also have thousands of pressure sensors, nerve endings in your skin, muscles, and connective tissue. Now, when you float in water, the area of pressure on these sensors is so large—as compared with the supporting area when you sit down, for example—that you may not feel the water pressure at all. It is like being weightless as far as your pressure sensors are concerned, but your otoliths still feel the pull of gravity."

"So if you want to be truly weightless, inside the earth's atmosphere, you have to fly a parabolic arc in a high-speed airplane?" I said.

"Either fly an arc or ride in an earth satellite," he said.

It was nearly four p.m. The left landing gear of the F-94 was dripping hydraulic fluid and Herb was down on his back wrestling with a wrench as I climbed the ladder to the back cockpit. Basil McLeod, crew chief, helped strap me down, plugged in my radio jack, and turned on the oxygen. As he disappeared down the ladder, he said, "Major Stallings will show you how to bail out . . . just in case."

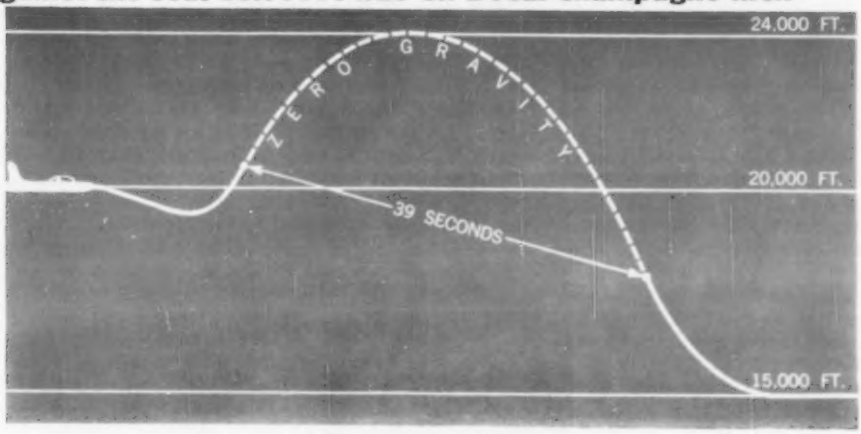
That's good of him, I thought. While Herb and McLeod plugged the hydraulic leak, I looked for a "burp bag"—and found one neatly stashed between two black boxes. I noticed that most of the instruments had been taken out of the back cockpit. There was no control stick, either. No chance to be a hero and land this thing if something happens to Herb, I said to myself.

Herb poked his head in under the canopy to give me final instructions. It turned out that blowing myself out of the F-94 would be comparatively simple: knees together, feet in the stirrups, jettison the canopy, left armrest up, right armrest up, squeeze trigger, pray.

"Let's go," I said.

At 4:16, Herb took a "thumbs up" from

against the seat belt . . . I was on a real champagne kick"



HOW ZERO GRAVITY WAS ATTAINED: Sketch traces trajectory followed by the F-94C Starfire from level flight through the parabolic arc that induced weightlessness for nearly 40 seconds.

McLeod and hit the starter button. I heard a dull whine behind me and almost immediately we were taxiing out. The mike in my oxygen mask picked up my breathing and sent it roaring into my earphones.

The F-94 is a solid, stub-winged interceptor that corners like a Jaguar, and Herb taxied her like one. I took a notch in my harness.

"Randolph Ground Control," he said, "Six Five Zero for a local flight. Over."

"Five Zero, cleared to runway three-two. Wind, six knots. Altimeter, 30.22."

"Roger," Herb said calmly. Then to me: "Okay, clear the canopy."

Instinctively, I pulled in my shoulders, and the canopy snapped down.

"Switch to 100-percent oxygen."

I fumbled for the switch.

"Ready, chase?" he called.

Capt. Warren Simpson pulled up beside us in a T-33. He would lumber along behind and below us to help us stay clear of traffic while we flew our parabolas. I heard him mutter, "Roger."

Herb got on the horn for final clearance and wheeled the F-94 into position for takeoff.

Something belted me in the backside. From the thunder that shook the F-94, I gathered that Herb had cut in the afterburner. Within 25 seconds, we were off and climbing. I started to look around at the view, but it was gone. "How fast are we climbing?" I said.

"About 6,000 feet per minute."

At that rate, the flight would be over before my stomach got off the ground.

We bounced through some clear-air turbulence and the F-94 shuddered. When she settled down, Herb said, "Are you all right?" and someone answered for me, "Affirmative."

"Okay," said Herb, "let's try one. Remember, I'll dive, climb, fly the arc and haul her out. We'll pull a lot of Gs at the beginning and the end."

At 4:40 p.m. we were at 20,000 feet, boring through the Texas sky at 400 knots. Herb nosed her over. The sky disappeared upward and the F-94 dropped like a streamlined stone. Then, before I was ready, he hauled back on the stick. It felt like someone was piling Sequoia logs on my shoulders, my back, my head. Then, from somewhere in the distance, I heard the afterburner cut in and I knew we were rocketing almost straight up.

"Here we go!" yelled Herb.

And I slipped into another world, a world of delicately blurred sights and sounds. The cockpit was pleasantly hazy, the roar of the engine agreeably muffled.

I noticed that my feet were off the floor and that my body was floating upward ever so lightly against the seat belt. I was on a real champagne kick. Man,

I thought, don't let it ever end . . . and a pile driver smashed me down into the seat. We had indeed pulled a lot of Gs as Herb brought us back level.

When I came back up for air, I said, "How long were we weightless?"

"That was a shorty," he said. "About 25 seconds."

I knew then that while we were weightless I had lost my sense of time. I felt the way you do when you're just about to drop off to sleep and you come back to full consciousness with a start.

The next one was as pleasant as the first. I was floating, and everything inside me was floating. I was happy as a kid on Christmas morning.

I laid my pencil on the palm of my hand and gently let it go. The pencil floated away. I laughed and reached for it, but my weightless arm overshot. Accidentally, my fingers brushed the pencil, but it did not fall. I felt as though I had made a great discovery. I wanted to catch the pencil and throw it up in the air and yell with joy . . . when the pile driver hit me again.

"That one was better," said Herb. "About 35 seconds."

"Let's go for the record," I said. "I've got to get serious and do some work. I've got to act like a spaceman."

My watch read 4:58 just before we went down again. During this parabola, I closed my eyes. I was on the same kick, everything light and happy, but suddenly I felt as though I were rising out of my seat. I opened my eyes quickly, fearful that my harness had slipped loose, but it was still there.

I closed my eyes and drifted slowly upward once again. This time, I kept them closed and began a gentle forward somersault. Up and over I drifted until I opened my eyes and all the parts of the world scrambled back into their proper places. Sleep on a spaceship, at least for me, will be a long tumbling ride through nothingness.

SPACE SPECIALIST Dr. Siegfried Gerathewohl—with the kitten who is helping expand man's knowledge of gravity.

"Pretty good that time," said Herb. "Almost 40 seconds."

"Do you feel these strange sensations?"

"Not too much. When you're busy, you don't have time to notice. And watching the instruments keeps you oriented."

We augered down toward Randolph, bucking and skidding as the dive brakes fought to keep us from plunging straight in. At 3,000 feet we leveled off, and Herb popped the wing flaps. In seconds the F-94 was tamed and we were sitting down hard but smoothly on the long east runway, with our brake chute billowing behind us. I glanced at my watch again—5:17. It seemed to me that a lot had happened in one hour.

Back at Dr. Gerathewohl's office, I talked to Dr. Julian Ward. "What's the big problem," I said, "if you can find space pilots who get a bang out of this the way I did?"

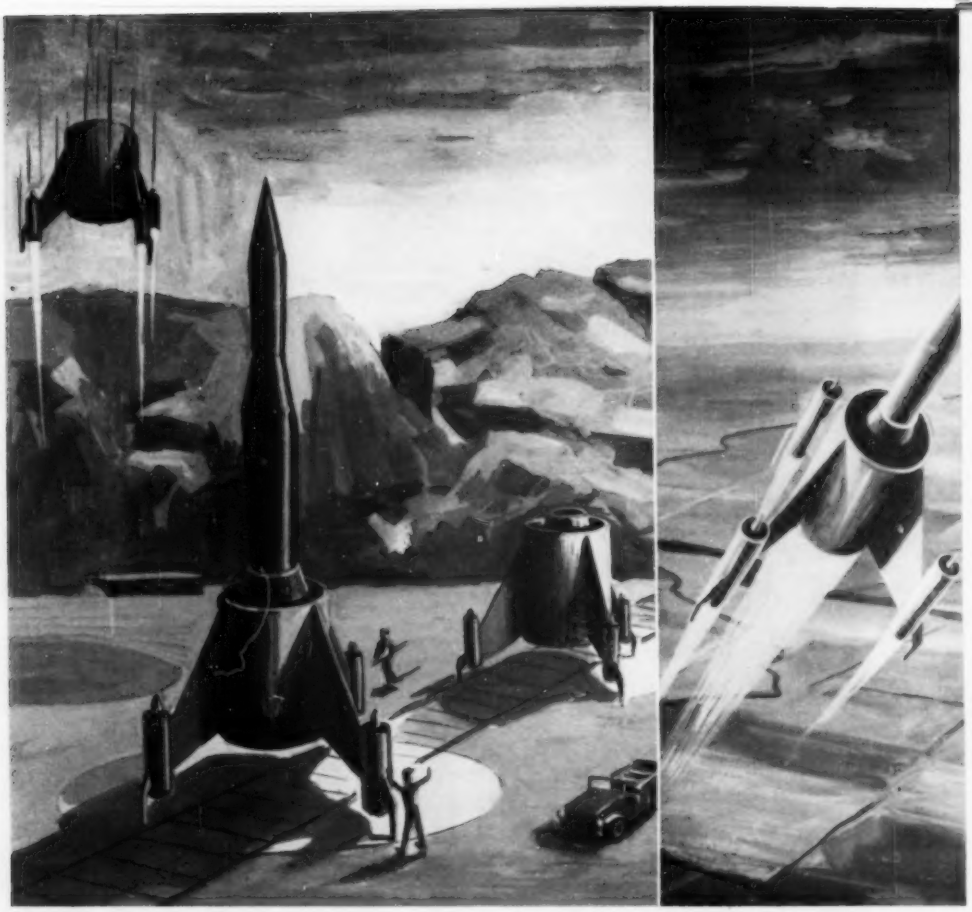
He told me that being weightless for days or weeks may be quite different from being weightless less than a minute. What's more, the medics don't know yet how zero gravity will affect the heart and other large organs or the blood pressure. They are concerned about the effect on our reflexes. Drop a cat upside down on the ground and he'll land on his feet. After 15 seconds of weightlessness, he can't do it.

Most researchers believe that a carefully selected, well-trained crew will not become airsick in space. Only about one out of three subjects gets violently sick in the F-94, and some doctors link their sickness with the sudden change from high positive G to weightlessness.

But the researchers are worried about the effect of zero gravity on coordination and muscular control. Most subjects aim too high if they reach for something. Vision is affected; the after-image of a light on the retina tends to drift upward during weightlessness. Eating and drinking are difficult. Sleeping may be a long nightmare. These are just some of the problems to be solved before we can put a man safely into space. END

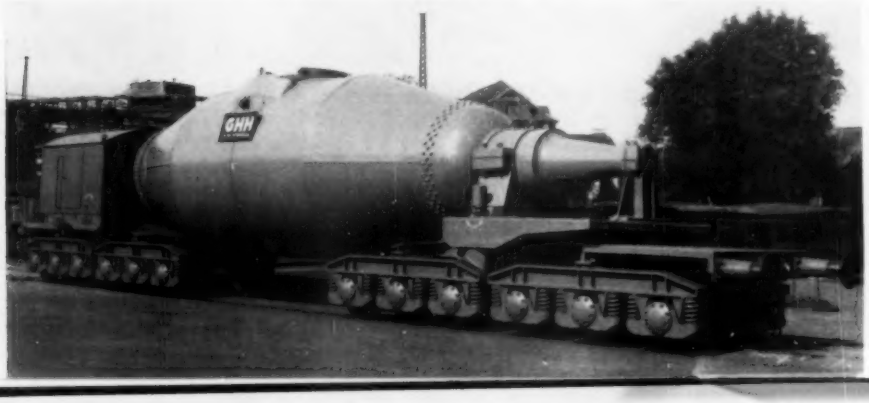
Picture News
IN THE WORLD OF SCIENCE

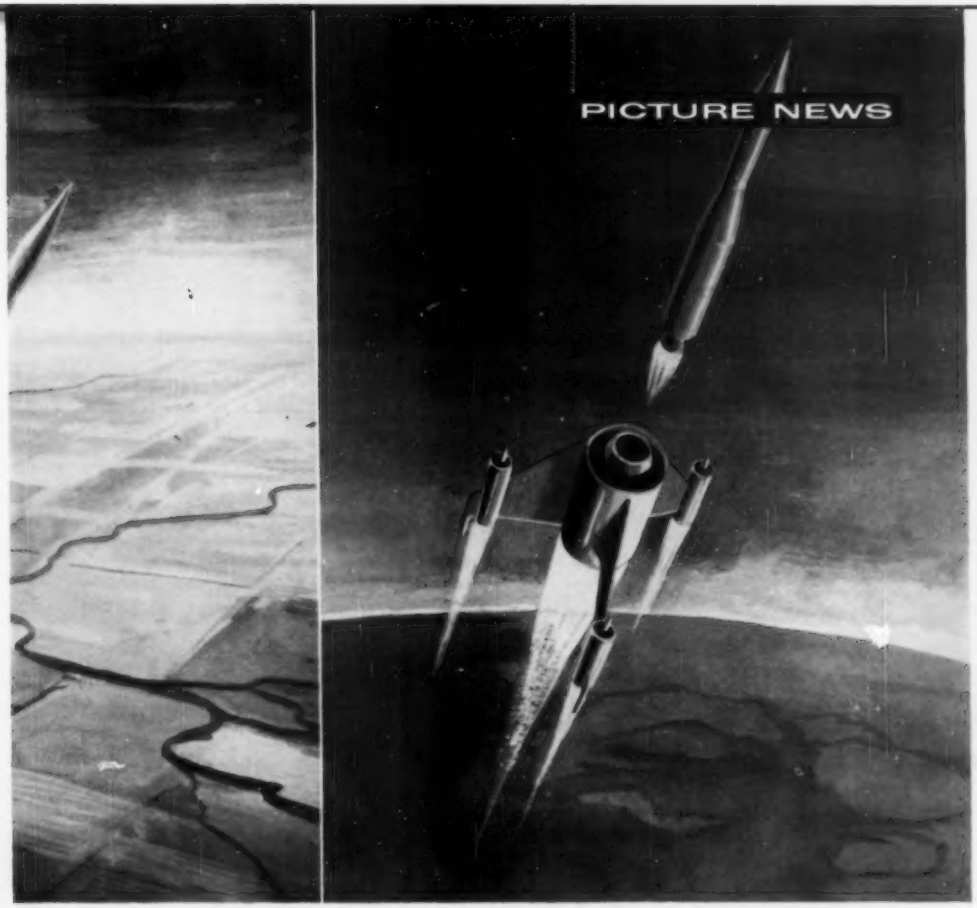
Car makes rugged climb. This incline, too steep for an unaided human climber, fails to stop a 1957 Buick Century. Built at the General Motors Proving Ground to test the climbing ability of military tanks, it has a 60-percent grade, or a 60-foot rise in 100 horizontal feet. A man had to cling to a rope to get to the top. San Francisco's steepest hill has a 31-percent grade; ski runs are seldom more than 45 percent. The Buick was powered by a 300-hp. engine and had Dynaflow transmission.



Jets to aid rocket launching? An ingenious new way to kick off missiles and space vehicles has been proposed by General Electric engineers. Jet engines, in effect a new first stage, would boost a missile up many thousands of feet before the missile's own rocket engines began

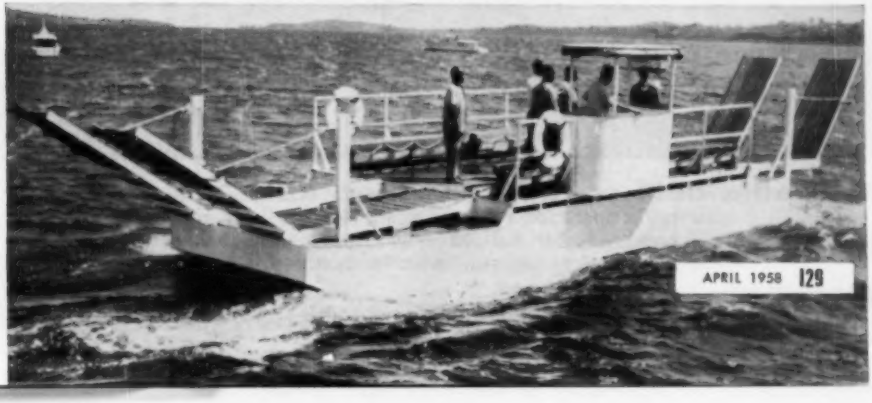
Rail car transports molten metal. This odd-shaped tank car slung between two pairs of three-axle trucks is used by the French State Railways to haul liquid pig iron from blast furnaces to steelworks in the Ruhr. It picks up its load at several smelting plants, rotates to discharge it through the opening at top. German made, it can hold 150 tons.



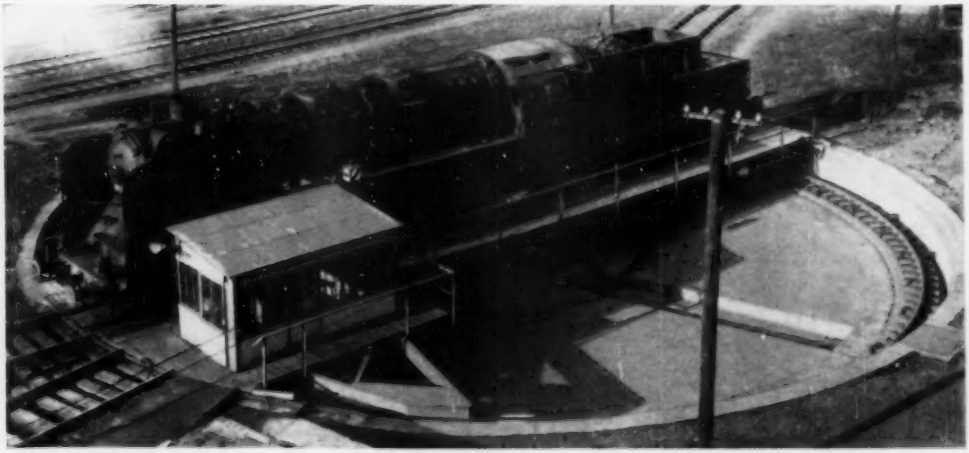


firing. Efficiency would increase because the jets, being air-breathing, wouldn't have to carry their own oxidizer. Other advantages claimed: The jets would be recoverable, and launching sites could be simpler. Shown above are three phases of the launching operation.

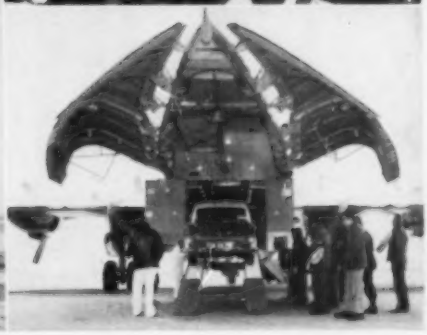
Ferry rides on water jets. No propeller or rudder is needed on the craft below. It travels on water sucked in by diesel and shot through ports at bow and stern. Two levers operate valves controlling flow to port and starboard. With one forward and the other back, it turns on its axis. It is run in Uganda by unskilled African crews, can carry a 10-ton truck.



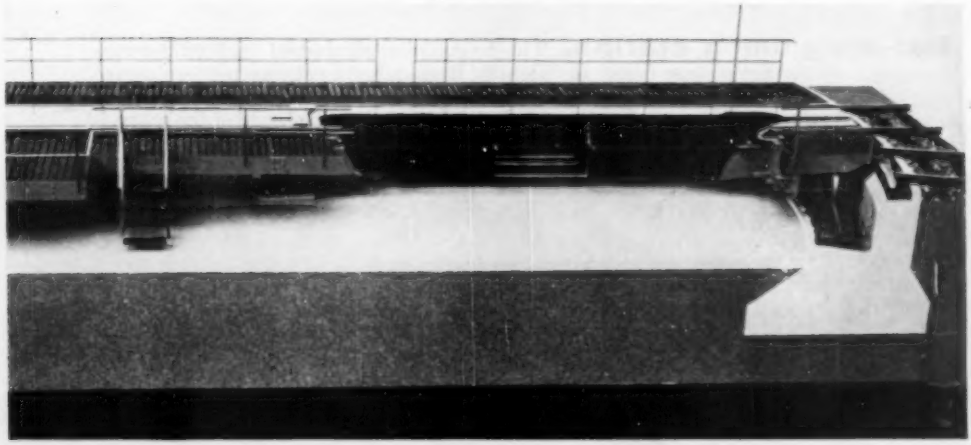
Plane carries passengers and cargo. Only airliner to have two full-length decks, the French Breguet Deux Ponts takes 59 passengers on the upper level and as much as four tons of cargo on the lower. With seats installed in the cargo compartment, it accommodates a total of 107 persons. The rear half of the upper deck can be removed to carry



Turntable built of tubular steel. When huge new locomotives were put in operation by the German Federal Railroad, they were found to be too heavy for the old-style turntables. Instead of strengthening those in service to take the extra loads, the railroad built new ones of



such bulky freight as military tanks. On its initial transatlantic flight to New York, the one above brought over two new 1958 eight-cylinder Simca Vedette Chambord cars. One is shown being unloaded by rear ramp at the lower right. The new Breguet, in Air France service, is powered by four Pratt and Whitney R-2800 engines and cruises at 230 m.p.h.



tubular-steel cross members. They carry more weight with a shallower draft of the bridge, thus lessening pit depth, and are cheaper to build. Above is a cutaway model showing the tubular-steel construction. At left is a big German 4-6-2 express locomotive on one of the new turntables.

Giant hand guides youthful pitchers. To teach thousands of boys at a time how to hold a baseball for various pitches, Bill Veeck, former club owner, uses this six-foot rubber hand and three-foot ball. Articulated fingers show grips, the ball swivels. Here Veeck demonstrates at Yankee spring training camp with Casey Stengel, manager, at his side.

Bat-wing filling station. The hyperbolic paraboloid roof of the new service station below in Wichita, Kan., adopts extreme modern design for utilitarian building construction. The 40-foot-square roof was put up first on pillars and walls added under it. Major advantage of the shape is great strength at light weight. The one shown is but three inches thick.

Computer solves steering problems. Using a wheel linked through an analog computer with a miniature car standing on a "handling" simulator, General Motors research engineers above study stability and control of an automobile still in the design stage. Servo mechanisms in the simulator respond to turns of the wheel as a car would on the road.

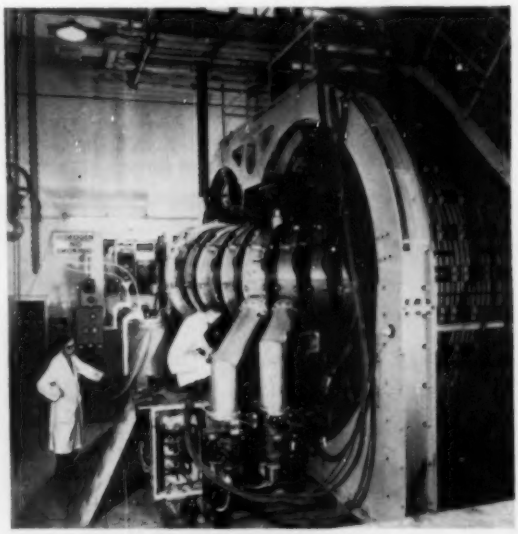
For illegal parkers. Police in Hamburg, Germany, now have easy-to-use equipment for towing off cars left in no-parking zones. It consists of four rubber-tired two-wheel dollies that can be attached in a few minutes to the jacked-up wheels of an illegally parked automobile. Officers no longer have to force open a car to release brakes or disengage gears.

ELECTRIC DISCHARGE of this ring of big condensers gives 1,000,000-ampere current and sunlike heat in Los Alamos' straight four-by-12-inch Columbus II tube (unseen in photo) below center.

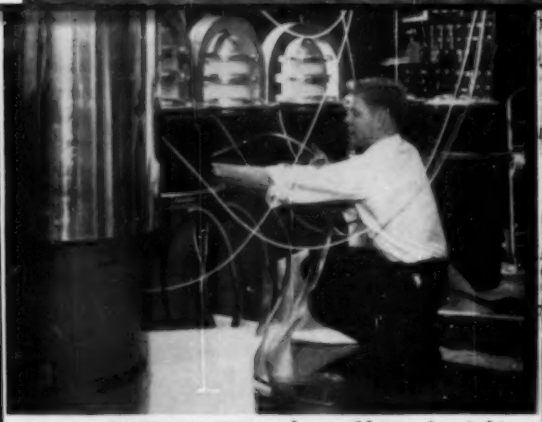
Bottled suns. Newly unveiled are these latest atomic-fusion machines at our Los Alamos Scientific Laboratory, and a giant British one called Zeta—along with their feats up to now.

All are "magnetic bottles" for thermonuclear experiments that may harness the multimillion-degree reaction of the H-bomb for power (PS, Feb., '58). The magnetic effect of a heavy electric current, induced in a tubeful of gas, compresses and heats the gas—and holds it away from the tube's wall, to keep the apparatus from melting.

With lightning-like currents of up to 1,000,000 amperes, the modest-sized U. S. tubes have set a 10,800,000-degree-F. record. England's huge Zeta, initially wielding 200,000 amperes, holds almost-as-high temperatures much longer in its great aluminum tube of 3¼-foot bore and 10-foot diameter. The first big-scale U. S. fusion machine, the Model C Stellarator, will be ready within two years.



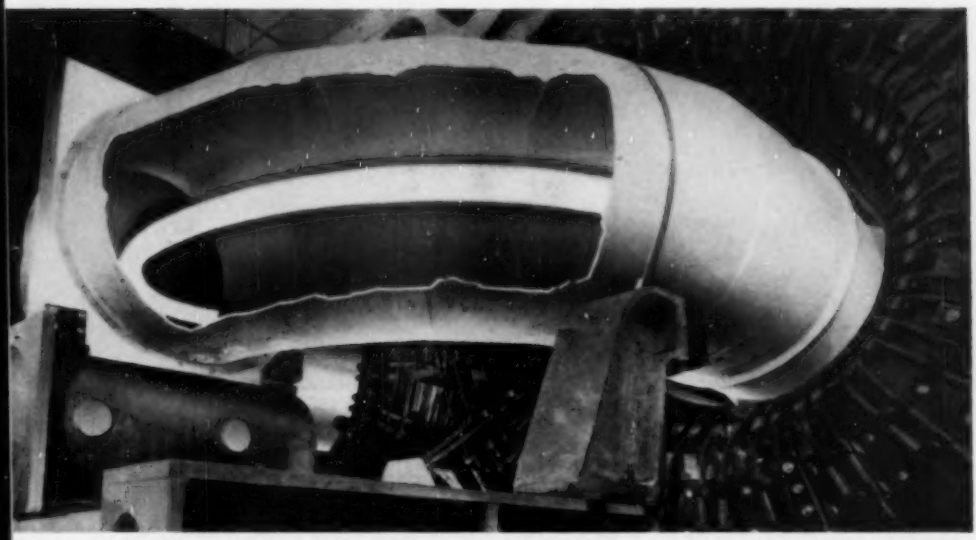
First big-scale H-machine: England's Zeta.



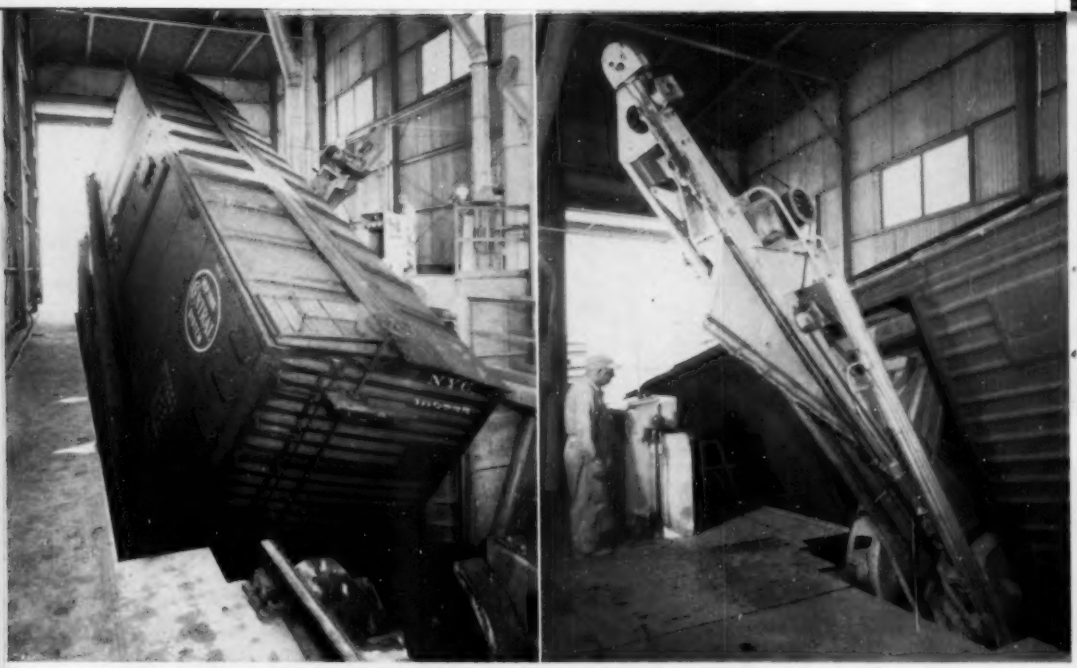
SPARK-GAP TESTS solve problems of switching huge electric power from condensers into tubes.

DOUGHNUT-SHAPED PERHAPSATRON TUBE momentarily yields record of 10,800,000 degrees.

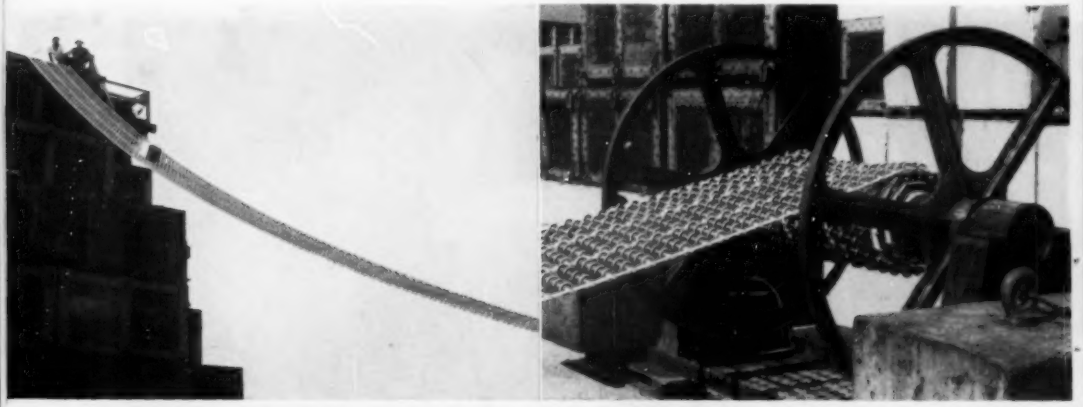
LARGEST U. S. FUSION TUBE publicly shown is five-by-24-inch Columbus S-4, made of porcelain.



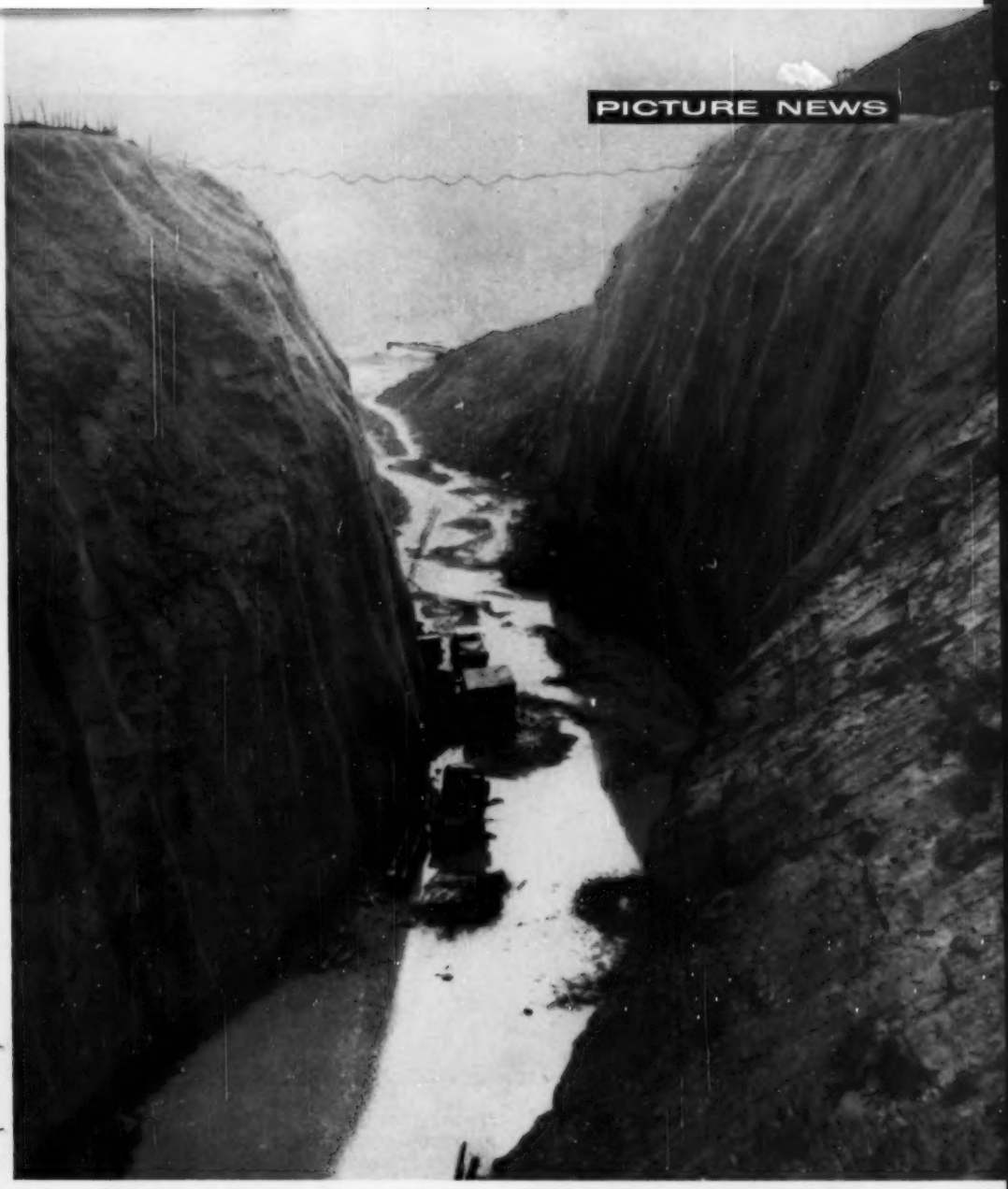
This photo-diagram of Zeta's giant tube shows its hot gas (white ring) pinched to center.



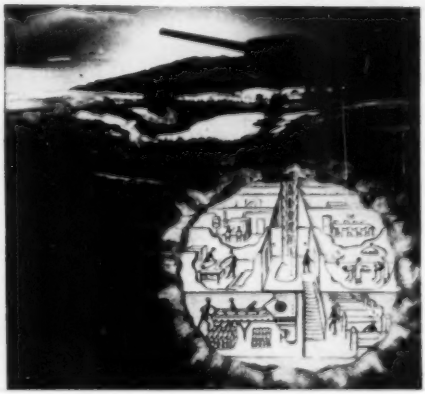
Tilting bed unloads fast. A big boxcar rolled onto this platform and locked in place is tipped in three directions to be emptied of 2,000 bushels of grain in 4½ minutes. The device at right forces open the door when the car is tilted, first at one angle then to the other, to let grain pour from both ends. Then a baffle is inserted and the platform tipped 40 degrees to unload the car completely. Two of these tilters were built by Link-Belt Company for Chicago elevators. Each can handle 10 cars an hour.



Sea-borne conveyor gets dry-land test. This flexible gravity belt is equipped with skate wheels for transfer of cargo at sea between ships with a difference in deck heights, such as from a supply ship to a destroyer. Shown here in a shore test at the Naval Supply Research and Development Facility, Bayonne, N. J., it is made of four strips of nylon webbing slotted for axles carrying a number of small nylon wheels. Action of the wheels tends to center the cargo. At right is a reel for stowage.



Man-made canyon. This huge cut—200 feet deep and 725 feet long—was dug through a mountain to channel water to the powerhouse of the Swift hydroelectric project on the Lewis River at Cougar, Wash. More than a million cubic yards of rock and earth were removed by scores of shovels during excavation for the new river bed. At this point wire mesh covers the steep sides to protect workers from slides and falling rocks while trucks use the muddy floor for a highway before the water is let in.



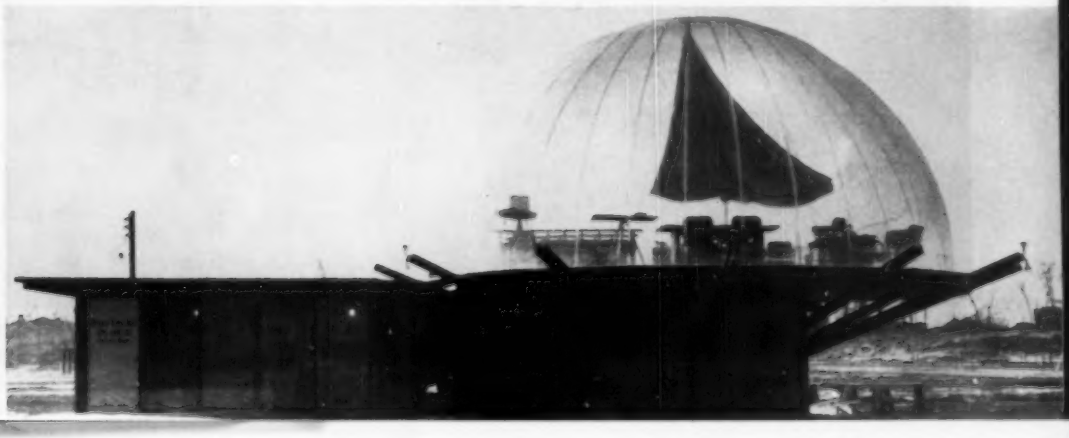
Ready for atomic war. The strategy of military leaders in Sweden is to dig deep in preparation for the next conflict.

Above a warship rides at its mooring inside an underground base from which the navy would operate hit-and-run raids.

At left is a diagram of a coast-artillery battery in which nothing but the gun is exposed. Living quarters, ammunition, fire-control centers and hospital facilities are buried far down below in the granite cliff.

Fuel train rolls on huge wheels. Ten tire-like rubber containers, each holding 500 gallons, are being pulled over rough ground by an Army Teracruzer. Mounted on special axles developed by Four Wheel Drive Auto Co., these five-foot-high Goodyear Rolli-Tankers haul fuel in quantity in sand, mud, swamp, ice and snow. The axles include a braking system and equipment that fills "tires" at up to 100 gallons a minute.

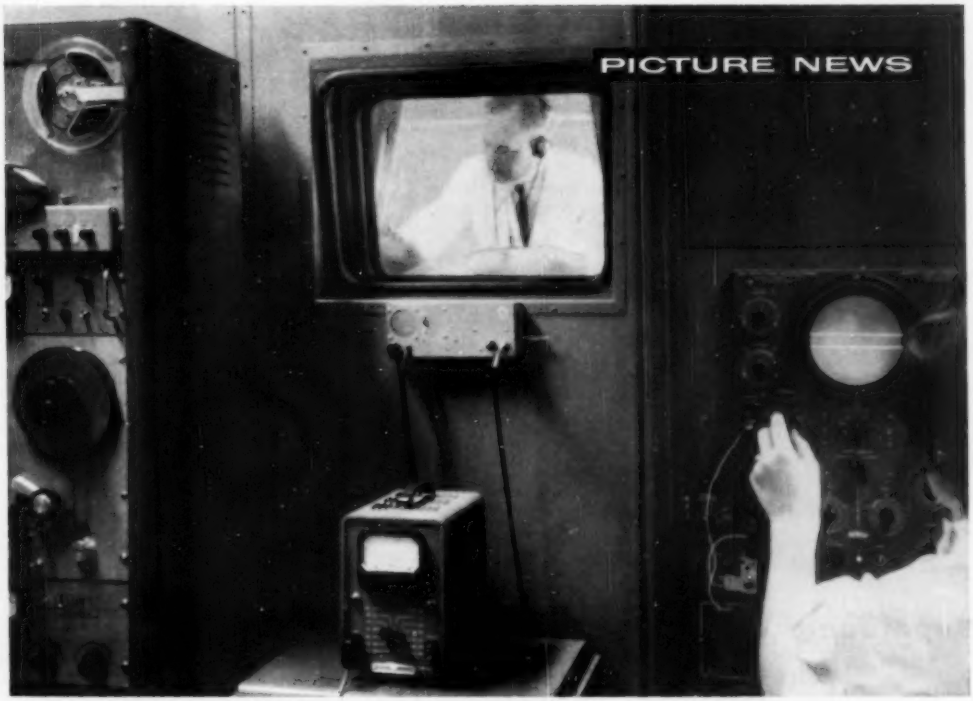
See-through air house. This new office building in a Minneapolis suburb is topped by an inflated bubble made of DuPont transparent plastic. Interior pressure is maintained by a small fan and airlock doors. The sail-like object hanging on the inside is a plastic shade to ward off hot sun. G. T. Schjeldahl Co. of Northfield, Minn., designed the structure.



Picnic car. Built into the trunk of this new British luxury auto, the Bentley Countryman, are a complete table and equipment for roadside meals. Also mounted in the compartment are a wash-bowl and mirror for washing or shaving.

Radar surveyor. The device above, a Tellurometer, cuts to an hour a surveying job that takes a 10-man transit party three weeks. Two transmit waves between them to measure distance. Developed in South Africa, it is also used in the U. S.

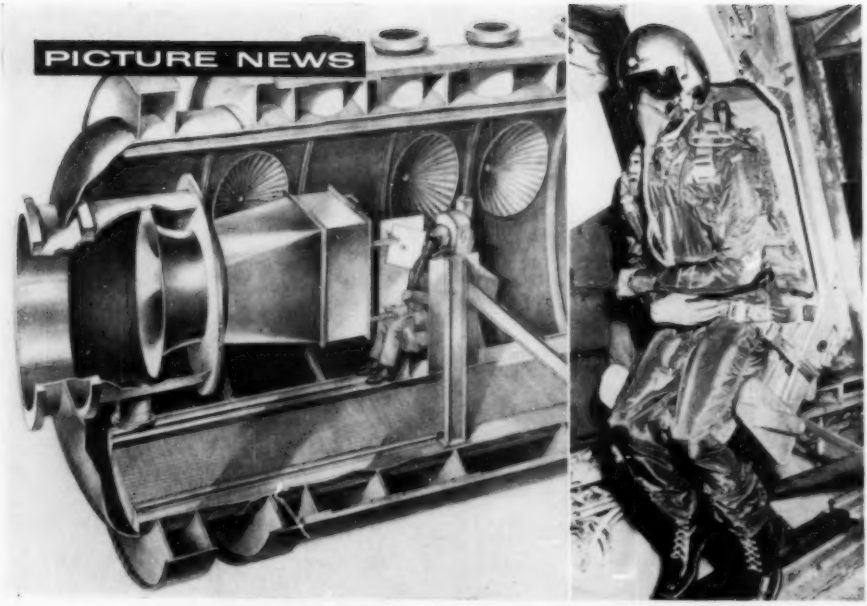
Monorail: Japanese style. This two-coach electric train riding a single overhead track is Tokyo's first experiment with monorails. It runs in one of the big parks; if successful, others will be put up over the city to help relieve traffic congestion. It operates on rubber wheels rolling in boxes above the rail. Small side wheels keep them from running off.



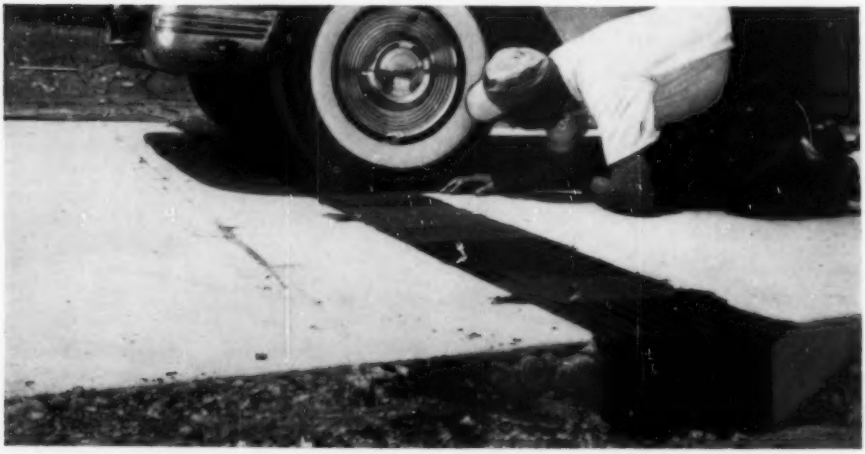
Engine-pressure pickup used on heart. An instrument called a capacitance pickup, first developed to determine auto-engine pressure, has been adapted by General Motors, with the help of a doctor, for use on human hearts. In a soundproof room (in window above), it detects even the slightest heart murmurs and records them as electrical signals.

Canopied transport. To keep sandstorms from marring paint on new cars, two-deck, covered auto transports are being used on Detroit-West Coast routes. A winch raises and lowers the top deck.

Jackknifing dinghy. This little boat folds in the middle to be towed along behind a car on one detachable wheel. It can also be loaded with luggage. The hinge is waterproofed, locks in water.



Supersonic ejection. A special seat, tilting (right) at various angles during phases of ejection, was built in a wind tunnel for the first time to try out this flying suit. It provides closer observation and control than rocket-sled tests. Martin engineers designed the suit with an oxygen mask and other parts that won't rip off during high-speed ejection.



Rubber road link. An expansion joint of special synthetic rubber is being made by Goodrich for experimental highways and runways. Consisting of spaced strips that absorb expansion and contraction of concrete slabs, it stays flush with the surface and provides a smoother ride.

Will a Super-City Swallow Your Town?

Our cities are spreading out, soaking up the suburbs. By 1975 three-fifths of us may be living in a new kind of community: Interurbia

By Guy Shipler Jr.

YOU may be a suburbanite today, but you'll be a city-dweller tomorrow—whether you like it or not. And you won't even have to move to do it.

For by 1975, the American suburb will no longer exist as a community with a specific identity. Instead, population experts now predict, it will be just one small section of a vast "city strip," which in some areas of the U. S. will stretch for hundreds of miles. Tomorrow your town's name will remain only as a tag for a small part of your particular super-city, just as today the name of the street you live on is a tag for a part of your suburb.

The reason for all this is that American cities are fast spreading toward each other, physically encompassing their suburbs. Your community will be a vital part of the merging of present-day Suburbia into a great social and economic community of the future which the experts call "Interurbia."

One study—under the combined efforts of J. Walter Thompson Co., an advertising agency; Yale University; and Fortune magazine—finds these broad changes which Interurbia will bring to your life:

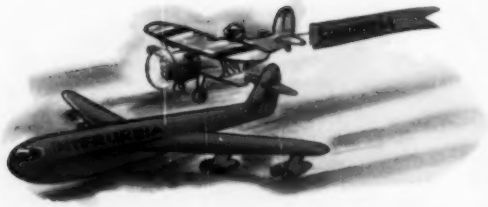
By 1975, about 60 percent of the U. S. population (estimated at somewhere between 207 million and 228 million) will live on between four percent and five percent of the total U. S. land area.

This area will contain about 20 separate Interurbias, throughout the nation. They will be formed by present cities soaking up suburbs and open country between them, until

As people and industry sprawl out away from the central city, homes and jobs, once tied closely together and firmly fixed in their places, are becoming more movable

finally they merge into one enormous overall community.

Yet this doesn't mean you will have neighbors crowding into your back yard. You and they will both actually have more space—population per square mile will continue its long-range drop in urban areas. Example: In the New York area, population ran at 20,000 per square mile in 1940, will be only 11,000 by 1975. Reason: Greater mobility (superhighways) will let Interurbias spread to wider boundaries. Thus, you and your neighbors will still enjoy the best elements of suburban life.



A new dimension in our economy is velocity . . . what's going to catch up with your suburb is the fact that this velocity is going to increase with explosive force

You can look forward to not only a bigger economy, but a more stable one. Reason: Your new neighbors, as metropolitan dwellers, own little property now. But when they move out from the central city, they will be forced to buy property—a stabilizing factor.

You'll be best prepared for the invasion if you *expect* it: All this will happen much faster, the experts tell us, than any change the world has known. "A new dimension in our economy . . . is velocity," says the Thompson study. "We as a nation have failed to anticipate the *pace* of our growth."

Past errors in forecasting bear this out. In 1946, the Census Bureau predicted a U. S. population in 1955 of 150 million. It turned out to be 167 million. That 17-million miss adds up to more than Canada's entire population.

Also in 1946, auto economists said we would be driving 36 million cars on U. S. roads in 1955. Instead, the actual number ran to 52 million. These 16 million extra cars total more autos than exist in all of Western Europe.

What's going to catch up with your suburb is the fact that this velocity is due to increase with explosive force.

Many suburbanites have already seen such forecasts start to come true. The signs are especially clear in Los Angeles, where the suburb already has almost ceased to exist. The city itself, 455 square miles and two million population, is merely the core of an Interurbia—a vast complex of satellites, extending far beyond Los Angeles County. These areas add another 4,800 square miles, boost the total population to six million. The small communities making up this area are fast losing their individual identity as suburbs.

Like fried eggs in a pan, the "yolks" were the central cities, the "whites" the surrounding suburbs. But as they spread toward each other, the result is scrambled eggs

Actually, the whole pattern of city expansion has changed. Traditionally, it has been like fried eggs in a pan—the "yolks" were the central cities, the "whites" the surrounding suburbs. Each had its distinctive qualities. But as the eggs spread toward each other, and finally meet, the result is "scrambled eggs."

Thus all the elements of your life will be intermingled—your residence, your work, your play. Instead of commuting with your neighbors toward the central city in a one-way stream, you may go to work in the *opposite* direction. And because business and industry are already leapfrogging suburbs—with clean, modern plants and offices going up near residential areas—you may get to work in a quarter of the

Interurbia in 1975: about 60 percent of the U. S. population (estimated at 207 to 228 million) will live on four to five percent of the total land area

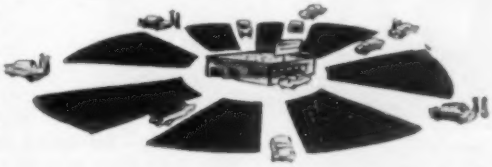
time it takes you now. It will be easier for your kids to get to school, for your wife to shop.

How quickly you can expect your particular suburb to lose its individuality depends on where you live. It will happen a lot faster in the 14 present Interurbias—but they are little more than seeds of the future.

Best yardstick to judge your own situation is to see how closely it fits the experts' definition: An Interurbia must contain two or more adjacent metropolitan areas with either: (1) two cities of 100,000 or more each; or (2) one city of 100,000 and three of 25,000 or more. In both cases, it must have adjacent counties with less than 25 percent farm population and more than 100 people per square mile.

Your Interurbia will grow fastest if you live either in the Northeast or in California. The 600-mile eastern super-city now growing along the Atlantic and creeping up the Hudson may sprout a westward leg, linking up with Cleveland, Chicago and Detroit to make a city strip 1,200 miles long.

California suburbanites can look for the same sort of thing—and soon: An urban strip stretching from San Diego north to connect in the Sacramento Valley with a southward movement from San Francisco. Other Interurbias in 1975 may not be as big. But they will be just as effective, undoubtedly, in changing your way of life.



Because business and industry are already leapfrogging the suburbs—with modern offices and plants going up near residential areas—you may get to work in a quarter of the time it takes you now

That effectiveness may well include changes in basic economies. The one-industry city may vanish (as it has in Los Angeles), extending the "scrambled-egg" quality to employment as well as social structures. Thus while your neighbor may be in a job similar to yours now, in the future he may be at a totally different post. In fact, machinists, professors, and dog-catchers may all live in far more similar fashion

—cars, houses, furnishings, appliances—than they do now.

However, as an Interurbian, the experts say, you will have a growing desire to be socially different from your neighbors —the uniformity of present-day mass housing is already bringing this out. As the Interurbian male, you will have a normal desire for achievement—you'll look for both prestige and acclaim. You will want to be a leader, to influence others. You and your wife will both feel a need for being sometimes the center of attention.

You and your neighbors will demand high quality in the goods you buy; together you will make up the group that determines when a luxury becomes a necessity

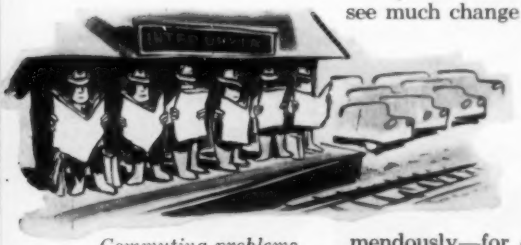
Your community will have a growing sophistication—because the spreading city will bring sophisticated urban ideas and sophisticated people into Interurbia. You will like variety and novelty, will be ready to try things new and different.

And you and your neighbors will demand high quality in goods you buy; together, you will make up the group that determines when a luxury becomes a necessity. You can look for some suburbs' prim, small-town qualities to disappear: Interurbians have a freer attitude toward sex—for example—and both men and women will be more willing to talk about it where you live than people do who live elsewhere.

Also: your Interurbia will have more women in proportion to men than other parts of the country. One estimate for the New York region in 1975: 87.6 men for every 100 women as against a national probability of about 92 men for every 100 women.

But what will all this mean to you if you live in a town of, say, 50,000 or less, with no big city nearby? Then you can look for changes similar to those of Interurbia, but on a smaller scale. There will be the same mushroom growth, a similar "scrambled-egg" quality of social and economic structure. Note that such relatively small communities already support as many as half a dozen shopping centers, for example, within a few miles of each other.

If you live on farms well away from Interurbia, you won't see much change at all. Interurbia won't need the space; it will grow mostly internally, using land still undeveloped within its orbit. (Only about half our land is used for crops and pasture and there's plenty of room to expand it for growing population needs.)



Commuting problems will be tougher for a while—until superhighways, planned to run through the heart of Interurbia, finally get built and operating

The same is true of parks and recreational areas—except right within the super-city, these areas won't be overrun.

Velocity will magnify old problems tremendously—for example, your community will be needing more and more schools. (Los Angeles right now needs a 32-room schoolhouse every week for the next 15 years.)

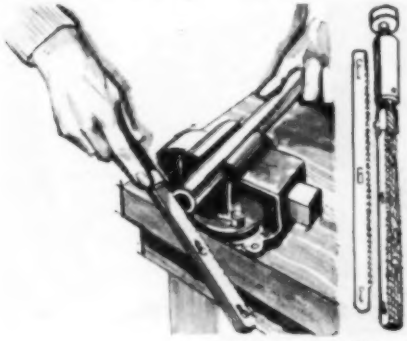
And your transit problems will be tougher for a while—until superhighways get built. That, in turn, may force you to move somewhere else in town: Present highway programs alone call for the destruction of 90,000 houses a year.

But on the whole, once the growing pains begin to ease, the men who foresee it say your new way of life will probably be a *better* way of life than you have ever known. END

New Ideas from the Inventors

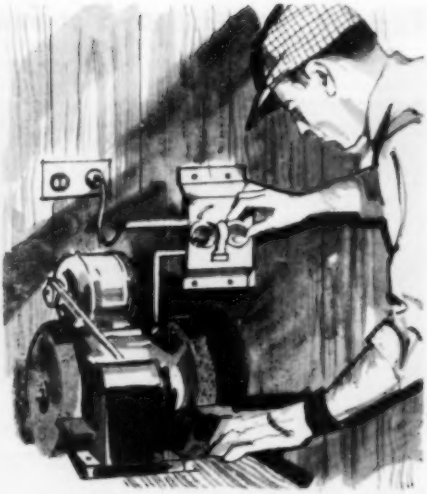
1 Screens Circle Drive-in. No matter where they parked, moviegoers would see pictures of equal size and brightness. With this recently patented arrangement of lenses and mirrors, a central projector could flash the same picture onto a number of individual screens. Each would serve a small group of cars.

2 Blade File Varies Cut. Made up of clamped-together hacksaw blades, this tool could be quickly changed from a fine-toothed file to a coarse, quick-cutting rasp. A screw (that would adjust the angle of a pin running through the slotted blade ends) would change the bite.



3 Harness Quiets Barking Dog. With a throat microphone acting as a switch for a built-in electric circuit, this outfit would give a dog a light shock every time he yelped. The inventor says the "mildly disagreeable sensation" would train a dog that barks or whines too much.

Please turn the page for more new ideas



4 Backlight Cuts Rearview Glare. Most methods of eliminating mirror glare also dull normal visibility. But, says this inventor, good mirror reflections without glare can be obtained by backlighting a glass that is treated to be partly reflective and partly transparent.

5 Goggles Unlock Machine. You couldn't mislay your eye protectors or forget to wear them before starting up a grinder that had a switch like this. A clip for the goggles would form part of the switch, so you'd have to remove them to start the motor, return them to stop it.

6 Refrigerator Serves Up Music. A radio built into the door of a refrigerator (and connected across the motor or light circuit) might conserve worktable space and help minimize kitchen clutter. Mounted at a convenient height in an insulated door recess, the receiver would be vented through its own front panel.

7 Power Lines Relay Warning. Connected to an AC outlet, this plug-in alarm would sound off when normal line frequency was changed at the power station. At other times it would remain silent and draw no current. The system would spread air-raid or other alarms instantly.

8 Rain Sock Protects Cuff. You wouldn't have to have your pants pressed after being caught in the rain if you carried a pair of these plastic socks. Worn inside your shoes, the "oversocks" would keep your feet dry while the leg covers protected the cuffs. A clamp designed to hold a trouser crease would support the upper part of each sock.

9 Armrest Guards Rider. Extended as shown, this pivoted armrest would keep an auto passenger from being thrown forward by sudden stops or being bounced upward if the car hit a bump. The protective arm, which would fold back against the car side, could be size-adjusted to suit children or grown-up riders.

The following patents *have been issued on these inventions: 1. Patent No. 2,734,420 to Tom F. Smith, Urbana, Mo.; 2. No. 2,738,568 to Gennaro Civitelli, Hamden, Conn.; 3. No. 2,741,224 to Tracy J. Putnam, Beverly Hills, Calif.; 4. No. 2,790,350 to Peter C. Cameron, Bethesda, Md.; 5. No. 2,800,543 to Michael D. Herzog, Brooklyn; 6. No. 2,795,639 to Alexander Rawson, Brooklyn; 7. No. 2,709,801 to William S. Sprague, Hollydale, Calif.; 8. No. 2,741,770 to Max Tannen, Brooklyn; 9. No. 2,805,081 to Maurice Frumet, Staten Island, N.Y.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, you may address him (by name and patent number) in care of the Commissioner of Patents.

Planning to buy a boat? Then hear this—

Bargain Boats Come in Kits

By George Daniels

HARBOR masters in some of the nation's leading ports report a startling new fact: As many as half of all small, private boats afloat never saw the inside of a factory or showroom. Some were homemade from scratch; many thousands more got their start as kits, either partly or wholly assembled by their owners.

Consumer News

That kit boats are popular is attested to by booming sales. One maker has already sold 50,000 of one model alone, another maker 40,000 of another model. And this is a small fraction of total sales since kit boats come in a staggering array of just about any type you can name, from prams, skiffs and runabouts to giant cruisers and even schooners.

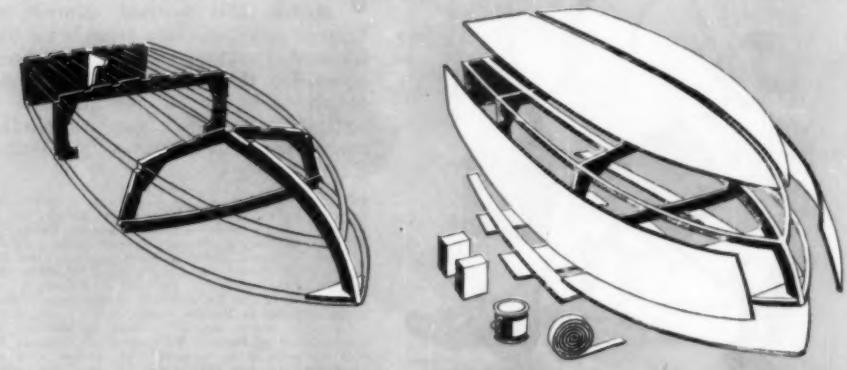
What do you gain? You can buy kits in any of several different stages of construction. If you start with a complete kit of parts and do the entire assembly job, you can have your boat for half the price of the same model factory-built. Order the same kit fully assembled but unpainted and you can still save about 15 percent by doing the finishing yourself.

You don't even have to buy a complete kit outright. Some makers offer a "pay as you build" plan, enabling you to buy your kit in several stages with parts pack-

You can buy kit boats in four different ways

FRAME KITS contain hard-to-make parts shown in black, offer biggest savings because you buy rest of lumber locally. A few kits also include longitudinal strips shown in outline. All kits give full plans for completing boat.

PRECUT KITS supply everything you need for complete boat, even screws and glue, but parts are rough-cut and require shaping and finishing. Preformed kits are similar, but have more work done for you, as shown at right.



Big sellers show the booming popularity of kits

MORE THAN 50,000 KITS have already been sold for Taft Marine's 12′ utility-runabout above. Complete precut kit costs only $95, frame kit $59. Estimated assembly time: 30 hours.

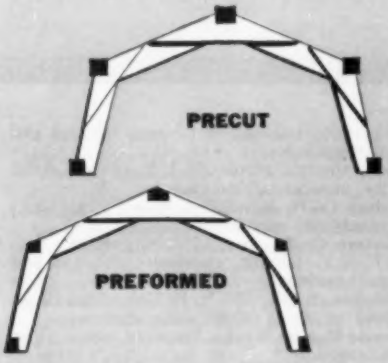
CHALK UP 40,000 MORE for this 8′ Roberts pram. It sells for $58 as kit, $110 assembled and $150 fully finished—so you can see what you save. Accessory sail kit also comes for $65.

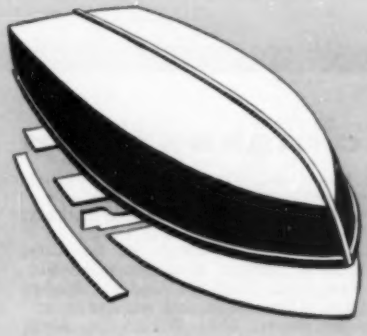
aged according to the order in which they will be assembled. You pay for the parts you receive, assemble them, then buy the next batch when your budget permits. Other makers let you make a down payment, then spread the rest of the boat's cost over 12, 24 or as many as 30 monthly payments.

Kits also permit custom tailoring not possible with ready-made models. Some builders like to start with a basic hull frame, then add their own styling touches in decking and interior design. Since most kits don't include hardware, you have the opportunity of choosing just what you want in deck fittings, steering wheels,

DIFFERENCE IN WORK YOU DO can be considerable, as shown below. In precut kits, longitudinals and other parts must be planed to match frame angles. Preformed kits come shaped to fit, may also be predrilled for screws and bolts.

PRE-ASSEMBLED KITS require least work, cost more, but come with a ready-built wood hull or molded glass-fiber hull. All you add are decking and interior details. This way, you're sure of a watertight job where it counts the most.





windshields, remote controls and other accessories.

Are they hard to build? Anybody who can do a household fix-it job can put a kit boat together. You use the same methods and the same tools. The tricky hard-to-make parts are already completed for you. There's no steam bending to do. Every part that has to take a curve has its shape when you get it or can be bent easily into position, either dry or after a brief water soaking.

What are your chances of finishing the job? The odds are excellent. One manufacturer who has been turning out kit boats for half a century claims that every kit his company ever sold has been successfully completed.

How long does it take? To build a typical 16′, 40-m.p.h. runabout, you put together as few as 11 parts to complete the hull, a total of 32 for the whole finished boat. Actual cases show that the average person can do the job in about 70 working hours, an experienced craftsman in less. Prams and small skiffs go together in around eight to 14 hours.

Some kits come with a one-piece molded glass-fiber hull that's ready to float when you get it and requires only seats and deck for completion. These cost more ($345 vs. $269 for a wood hull, for example), but if you're short on spare time and long on spare cash you can have your boat ready to launch in as little as 10 hours and still enjoy a sizable saving. An added advantage of molded hulls: The color you specify is "built in" and never needs repainting.

In another type of glass-fiber kit you home-mold your own hull in a mold lent to you by the manufacturer. A 16-footer takes about 50 hours to complete by this method and costs a little under $400.

If you like the advantages of tough, maintenance-free glass-fiber but prefer building with plywood, you can add a glass-fiber cover over the wood hull. Many kit manufacturers furnish all necessary materials in a supplementary kit to match your boat. You can cover a typical 18′ hull for about $70, eliminating permanently the need for painting anything but deck or cabin. If you use paint instead, the kit for hull, deck and cabin costs about $45.

What you get and don't get. Kits are classed in four general types according to the parts they contain and the amount of work already done for you. The extras included vary with each manufacturer and most catalogues list them in detail. Some even list the items specifically not included.

Frame kits are the lowest in price and include only the framework parts—usually the stem, transom, frames, and small items like breasthook and transom knee. To reduce shipping costs, most frame kits don't include longitudinal members like keel, chines, and sheer clamps. You buy lumber locally for these as well as for planking, decking, and the rest of the boat. Your frame kit contains complete plans and instructions for building the boat, and in some instances full-sized patterns for the parts you have to make yourself.

Precut kits contain all the frame parts, including longitudinal members, plus cut-to-shape planking, decking and all other wood parts. You also get the necessary

Who makes them

Acme Boat Co., Miamisburg, Ohio (Runabouts and outboard racers)

Alcort, Inc., P.O. Box 1345, Waterbury, Conn. (Sailing surfboard kits)

Bay City Boat Co., 304 State St., Bay City, Mich. (Inboard utilities, runabouts, cruisers)

Boat Kits, Inc., 1415 W. 92nd St., Bloomington, Minn. (Runabouts and cruisers)

Champion Boats, 1524 W. 15 St., Long Beach, Cal. (Outboard runabouts, inboard and outboard racing boats)

Chris-Craft Corp., Box 2002, Pompano Beach, Fla. (Prams, utilities, runabouts, inboard and outboard cruisers)

Craig Craft, Tonawanda, N.Y. (Prams, skiffs, utilities, runabouts, cruisers)

Culver Craft, Box 381, Downey, Cal. (Utilities, runabouts, cruisers)

Custom Craft, Inc., 1700 Niagara St., Buffalo 7, N.Y. (Prams, runabouts, inboard and outboard cruisers)

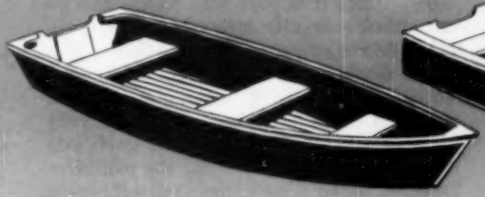
Dillabaugh Co., 220 N. E. Columbian Blvd., Portland 11, Ore. (Runabouts, cruisers)

Doane Marine Works, Stamford, Conn. (Precut fishing dory kits)

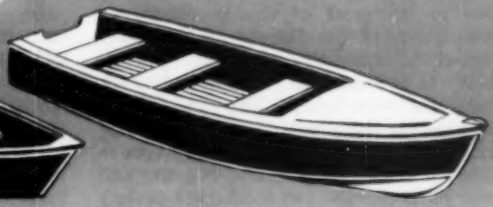
Douglass & McLeod, Box 311, Painesville, Ohio (Ready-built sailboat hulls)

Which type boat is best for you?

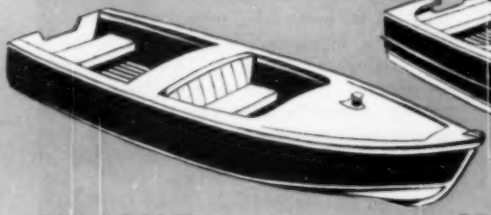
PRAM is squared off at both ends, eliminating tricky fitting at bow. Bottom can be flat (easiest to assemble) or slightly V shaped. Most common length is 8'. Prices range from $50 to about $70 for complete kit, are as little as $30 for frame only.



SKIFF has pointed bow but flat bottom, making it almost as easy to assemble as a pram. It's good for slow, stable rowing or outboarding, but is not built for speed. Lengths are usually 10' or 12'. Complete kits sell for $70 to $80, frame kits about $35.



UTILITY has V bottom, may be open or have short foredeck. Most hulls are "planing" type, similar to runabout, but a few are slower "displacement" type. Lengths run 12' to 16', prices from $120 to $290 for complete kits, $55 to $120 for frame kits.



RUNABOUT has fast "planing" hull, is fancy version of utility. It usually has longer foredeck, dividing center deck and often a stern deck. Lengths go up to 18', speeds up to 40 m.p.h., prices from $170 to $580 for full kits, $60 to $170 for frame kits.

CRUISER is biggest assembly job, but affords biggest savings. Sizes run from small 16-footers that sleep two ($350, complete kit), to big 23-footers that sleep three ($1,100). But—watch—frame-kit prices for same sizes are only $110 to about $200.

Fiberlay, Inc., 1158 Fairview N., Seattle 9 (Molded glass-fiber hulls and hull kits)

General Marine Co., 6th & Oad, St. Joseph, Mo. (Skiffs, utilities, runabouts, inboard and outboard cruisers, racing boats)

Glen L. Marine, P.O. Box 568, Compton, Cal. (Utilities, runabouts, racers, cruisers)

Ladd Built Boats, 1514 E. Scotts Ave., Stockton 5, Cal. (Assorted types of kits and preassembled hulls)

Luger Industries, 3404 Lyndale Ave., S., Minneapolis (Prams, runabouts, cruisers)

Milo Craft Boat Mfg., 7737 S. Western Ave., Chicago, Ill. (Assorted types of kits and premolded hulls)

Montgomery Ward, 619 W. Chicago Ave., Chicago, Ill. (Utilities and runabouts)

Robert B. McKean, 180 Prospect Ave. E., Mamaroneck, N.Y. (Racing sailboat kits)

Roberts Kit Craft, 12 Post Rd., Branford, Conn. (Prams, skiffs, racing sailboats)

St. Cloud Marine Mfg. Co., P.O. Box 695, St. Cloud, Fla. (Pre-assembled cruisers)

Sears Roebuck & Co., 925 S. Homan Ave., Chicago (Prams, runabouts, cruisers)

Taft Marine Woodcraft, 636 39th Ave. N. E., Minneapolis (Prams, skiffs, utilities, inboard and outboard runabouts, cruisers)

U-Mak-It Products, 569 U. S. Hwy. 92, DeLand, Fla. (Prams, skiffs, runabouts, cruisers)

bolts, screws, nails, and other fasteners, but not hardware or paint. Some manufacturers package hardware items in groups to match your boat kit; others sell them individually and let you pick the style and price you want. For a typical 16′ runabout kit, the basic hardware group costs $12.15, a remote steering setup (wheel unit, pulleys, cables, etc.) $33.40, and a plastic wraparound windshield, complete with brackets, $26.25.

In assembling a precut kit you usually have to do most of the beveling and "fairing in" of the framework to assure a good fit with the planking. This is chiefly a planing job, though a rasp is handy for some areas. The cut-to-shape planking sections will need some trimming, too, as they're slightly oversize to allow for snug fitting. Seats, flooring and cabin parts are also cut to shape, but may require similar fitting.

Preformed kits contain all the parts of the precut kit, but have more work already done when you get them. Most of the bevels have been machined on the framework so the most you'll need to add is a slight dressing down here and there.

Since hand shaping is a big part of the job, a preformed kit can be a substantial time- and work-saver. It's important, however, to know exactly what you're getting. In some preformed kits, only some of the parts are actually preshaped. On the other hand, some precut kits include a considerable amount of preshaping. Often the difference between the two types is very slight. A few kits, classed as "ready cut," are not only preformed but are fully assembled at the factory, then taken apart for shipping.

Most preformed kits naturally cost more than the precut type, but on small boats the difference can be as little as $10. On larger boats, such as a typical 18′ cabin cruiser, the difference can be big: $200. If you can't examine a kit before you buy, study the catalogue description carefully to be sure just how much work has been done and how much you will have to do yourself.

Pre-assembled and molded kits. In this group you'll find one-piece molded hulls, molded half-hulls that require only joining, preplanked hulls, and, in larger boats, completely assembled hull frames. The type of work remaining to be done differs with the manufacturer. Some molded hulls are complete with transom; some simply include a transom as part of the kit assembly job.

A pre-assembled hull assures you of a good tight job below the waterline, and still affords you a sizable saving through a home-assembled deck, cabin, and interior. Many kit manufacturers also sell fully assembled but unfinished boats. You do the painting and add the hardware, and you'll still save 10 to 15 percent.

What are the pitfalls? Experience shows that kit buyers who follow the instructions carefully have almost no trouble. The major cause of headaches is failure to read or follow the instructions and, sometimes, the use of "short cuts." Fortunately, a single mistake won't make your kit a total loss. If you spoil a part, you can get a replacement from the manufacturer or make a new one yourself, using the damaged one as a pattern.

If you want to start off easy, flat-bottom boats, such as skiffs and prams, are a good bet. The bottom joins the sides in a simple lap joint and goes together almost as easily as a box.

Boats with V bottoms are a little trickier to assemble, particularly if you choose a lapstrake design that requires the fitting of many individual planks. In general, plywood-covered hulls go together fastest because you work with big sheets, although some twisting of the plywood is required where it curves up at the bow.

If you like a particular boat but aren't sure you'd be able to assemble it, ask the manufacturer if assembly instructions are available separately. Many kit makers sell instructions in advance for a small charge, in some cases refunding the price when you buy your kit. This way, you can see the kind of work you'll be doing and decide whether you want to undertake the job.

The right tools save time. A spiral ratchet screwdriver, or a screwdriver attachment for an electric drill, is handy when you have to drive more than 1,000 screws in a hull—not unusual in an 18-footer.

Combination bits for electric drills will bore screw holes for the thread, shank and countersunk head in a single operation. Later, you can also use sanding disks in the drill to speed finishing. An-

[*Continued on page 240*]

Your Guide to the '58 Power Mowers

The pitch this year is convenience. And the improvements that make new machines easier to use hint of still more to come

By Martin Mann

YOU can spot the trend in this spring's crop of power mowers. It's convenience—easy starting, wide-cutting swaths (for a faster job), safety, smart appearance. The talk in the trade is that this is only the beginning.

Many '58 models are restyled versions of the '57s. But the changes that did show up are significant, hinting at more general and more radical improvements to come.

The chart on pp. 156-7 details specs for 46 models of 18 makes. All are hand-pushed rotaries of the popular 18- to 22-inch size. (Rotary machines are definitely the preference of the average home owner. They will account for 90 percent of all mowers sold.)

New for '58. One important development is price: Some makes are cheaper

FUEL-TANK HANDLE—no stoop, no hazard from gas spilled on hot engine—marks new Reo. Height-adjuster knobs at wheels, engine controls at handle are conveniences on many '58 mowers.

Facts and Figures on

MAKE AND MODEL		PRICE	CUTTING WIDTH	WEIGHT (lb.)	ENGINE: MAKE AND MODEL	CYCLES	HORSEPOWER AT WHAT R.P.M.	TORQUE (lb.-ft.) AT WHAT R.P.M.	AREA OF MAINSHAFT BEARING (sq. in.)	AIR CLEANER
BOLENS	6118	$ 58	18"	50	Power Products AV47	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	6218	$ 80	18"	55	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
	6219	$ 95	19"	60	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
CASEY MOW	19SE2R	$ 59	19"	46	Power Products V-47-618	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	19SE4R	$ 70	19"	50	Clinton VS 2100	4	2.0 @ 3,600	3.2 @ 3,000	1.70	dry
CHOREMASTER	18EC-3	$ 65	18"	60	Power Products V-47	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	18EC-2	$ 80	18"	60	Clinton VS 2100	4	2.0 @ 3,600	3.2 @ 3,000	1.70	dry
	18FW-1	$ 95	18"	65	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	dry
DILLE & McGUIRE Turfmaster	Aero L18	$ 55	18"	38	Power Products V-47	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	Aerolite A18R	$ 80	18"	43	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
	King RA18R	$100	18"	58	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
ECLIPSE	Pal	$ 50	17"	39	Power Products V-47-60517	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	Duo-Master	$105	19"	53	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
	Duo-Master F-19	$110	19"	50	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
HOMKO	AP 819	$ 60	19"	n.s.	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
	JK50	$ 90	18"	56	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
JACOBSEN	63	$ 80	18"	56	Jacobsen J-100VESJ	2	1.8 @ 4,000	2.4 @ 4,000	b	dry
	77	$ 93	18"	57	Jacobsen J-100VES	2	1.8 @ 4,000	2.4 @ 4,000	b	dry
	75	$140	18"	79	Jacobsen J-125VS	2	2.25 @ 4,000	3.1 @ 4,000	b	dry
LAWN-BOY	3200	$ 70	18"	38	Lawn-Boy C-21	2	1.85 @ 4,000	3.0 @ 2,800	2.63	dry
	5200	$ 90	18"	44	Lawn-Boy C-13	2	2.5 @ 4,000	3.5 @ 3,000	2.63	dry
MONTGOMERY WARD	HM-125A	$ 60	18"	50	Power Products V-47-615	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	HM-1A	$ 90	19"	63	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
MOTO-MOWER	Catalina Standard	$ 90	18"	50	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
	Catalina DeLuxe	$100	18"	48	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
PENNSYLVANIA	66218B	$100	18"	55	Briggs and Stratton 6B-HS-XM	4	1.75 @ 3,200	3.0 @ 2,600	1.78	oil
	67221	$110	21"	65	Briggs and Stratton 6B-H-XM	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
REO	TLR-218	$ 70	18"	49	Motor Wheel Corp.	2	2.1 @ 3,400	3.0 @ 3,400	6.48	dry
	TLR-221	$ 80	21"	54	Motor Wheel Corp.	2	2.1 @ 3,400	3.0 @ 3,400	6.48	dry
	TLR-421	$100	21"	59	Motor Wheel Corp.	4	2.5 @ 3,400	3.9 @ 3,400	6.36	dry
SAVAGE	Olympic 48	$ 68	18"	50	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
	Olympic 49R	$ 83	20"	57	Briggs and Stratton 6B-H	4	2.25 @ 3,600	3.4 @ 3,200	1.78	oil
	Savage 30T	$100	18"	52	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
SEARS, ROEBUCK	Dunlap 8143	$ 40	18"	43	Power Products V-47-601	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	Craftsman 8811	$ 70	18"	62	Craftsman 143.60020	4	2.0 @ 3,600	3.1 @ 3,200	1.98	dry
	Craftsman 8817	$ 80	18"	58	Craftsman 143.50020	4	2.0 @ 3,600	3.1 @ 3,200	1.98	dry
SPIEGEL	8211	$ 47*	19"	45	Power Products V-47	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	8120	$ 59*	21"	65	Clinton VS 100	4	2.5 @ 3,600	3.8 @ 3,000	1.70	dry
	8210	$ 70*	22"	66	Briggs and Stratton 8B-H	4	2.75 @ 3,600	4.3 @ 3,000	1.78	oil
SPRINGFIELD	Special 5819-2C	$ 60	19"	49	Power Products V47-618	2	2.0 @ 3,400	3.2 @ 3,000	a	dry
	Super 5819-CL	$ 75	19"	53	Clinton VS 2100	4	2.0 @ 3,600	3.2 @ 3,000	1.70	dry
	Sovereign 5822-BS	$ 85	22"	56	Briggs and Stratton 8B-H	4	2.75 @ 3,600	4.3 @ 3,000	1.78	oil
TORO	Standard Whirlwind 21017	$ 90	18"	46	Briggs and Stratton 6B-HS	4	1.75 @ 3,200	3.0 @ 2,900	1.78	oil
WESTERN AUTO	Wizard 2X2708	$ 48	18"	32	Clinton V 5200	2	2.0 @ 3,800	2.75 @ 3,800	1.94	dry
	Wizard 2X2809	$ 63	18"	40	Clinton V 32100	4	2.0 @ 3,600	2.9 @ 3,600	1.70	dry
	Wizard 2X2817 Custom	$ 80	19"	49	Briggs and Stratton 6B-S	4	2.25 @ 3,600	3.3 @ 3,600	1.78	oil

NOTE: n.s. This information not specified by manufacturer
* one needle bearing, one powdered-metal bearing
b two ball bearings, one needle bearing
c average thickness

1958 Rotary Mowers

CUTTER								BODY				
MUFFLER SIZE (cu. in.)	STARTER	HOW CLOSE TO WALL CAN MOWER TRIM? Front	Side	HEIGHT OF CUT Lowest	Highest	LEAF MULCHER	HOUSING MATERIAL	WHEEL DIAMETER Front	Rear	WHEEL MATERIAL	WHEEL ARRANGEMENT	WHEEL BEARING
4.0	rope	1/2"	3/8"	1"	2"	included	14 ga. steel	6"	6"	plastic	in-line	nylon
16.5	recoil	1/2"	3/8"	1"	2-1/2"	included	14 ga. steel	6"	6"	plastic	in-line	nylon
16.5	foot	1/2"	3/8"	1"	2-1/2"	included	14 ga. steel	7"	7"	plastic	staggered	nylon
4.0	recoil	n.s.	1"	1"	3"	included	1/4" aluminum[c]	6"	6"	metal	in-line	nylon
6.6	recoil	n.s.	1"	1"	3"	included	1/4" aluminum[c]	6"	6"	metal	in-line	nylon
4.0	rope	5"	1/2"	1"	3"	extra	14 ga. steel	7"	7"	steel	in-line	powdered metal
6.6	recoil	5"	1/2"	1"	3"	extra	14 ga. steel	7"	7"	steel	in-line	powdered metal
6.4	recoil	5"	1/2"	1"	3"	included	14 ga. steel	7-1/2"	7-1/2"	steel	in-line	powdered metal
4.0	rope	n.s.	1/2"	1"	3"	extra	5/32" aluminum	7"	7"	steel	in-line	nylon
6.4	recoil	1/2"	1/2"	1"	3"	extra	5/32" aluminum	7"	7"	steel	staggered	nylon
6.4	recoil	n.s.	1/2"	1"	3"	included	3/16" aluminum	8"	8"	steel	in-line	nylon
4.0	rope	1/2"	1/2"	1"	3"	included	14 ga. steel	6"	6"	plastic	in-line	nylon
6.4	recoil	1/2"	1/2"	1"	3"	extra	14 ga. steel	6"	8"	steel	staggered	ball
6.4	recoil	1/2"	1/2"	1"	3"	extra	1/4" aluminum	6"	8"	aluminum	staggered	ball
6.4	recoil	3/8"	3/8"	1/2"	2-1/4"	extra	16 ga. steel	6"	6"	steel	in-line	powdered metal
6.4	recoil	3-1/2"	3/8"	1-1/2"	3"	extra	16 ga. steel	6-1/2"	6-1/2"	steel	in-line	powdered metal
12.5	recoil	2"	3/8"	1"	3"	none	14 ga. steel	6"	6"	steel	staggered	sleeve
55	recoil	1-1/2"	3/8"	3/4"	2-3/4"	included	1/10" aluminum[d]	6"	6"	steel	staggered	sleeve
55	recoil	1-3/4"	3/8"	3/4"	2-3/4"	included	5/32" aluminum	6"	8"	steel	staggered	sleeve
57	rope	3/8"	3/8"	5/8"	2-5/8"	extra	1/8" aluminum	6"	8"	plastic	staggered	nylon
75	recoil	3/8"	3/8"	1"	3"	extra	1/8" aluminum	6"	8"	plastic	staggered	nylon
4.0	rope	1-7/8"	1/2"	1-1/4"	3"	extra	14 ga. steel	5"	7"	steel	staggered	powdered metal
16.5	recoil	1-7/8"	1/2"	7/8"	2-3/4"	included	3/32" aluminum[d]	6"	9"	aluminum	staggered	powdered metal
6.4	recoil	1/2"	3/8"	1"	3"	extra	1/8" aluminum	6"	8"	steel	staggered	powdered metal
6.4	recoil	1/2"	3/8"	1"	2-1/2"	extra	1/8" aluminum	6"	8"	steel	staggered	powdered metal
16.5	recoil	1-1/8"	1/2"	1"	3"	included	3/16" aluminum	7"	7"	steel	staggered	sleeve
16.5	recoil	1-1/8"	1/2"	1"	3"	included	3/16" aluminum	7"	8"	steel	staggered	sleeve
2.5	recoil	3/8"	3/8"	1"	3"	none	14 ga. steel	6"	6"	steel	in-line	powdered metal
2.5	recoil	3/8"	3/8"	1"	3"	included	14 ga. steel	7"	7"	steel	in-line	powdered metal
8.0	recoil	3/8"	3/8"	1"	3"	included	14 ga. steel	7"	7"	steel	in-line	powdered metal
6.4	rope	1/2"	1/2"	1"	2-3/4"	extra	14 ga. steel	6"	6"	steel	staggered	powdered metal
6.4	recoil	1/2"	1/2"	1"	2-3/4"	extra	14 ga. steel	6"	8"	steel	staggered	powdered metal
6.4	recoil	1/2"	1/2"	1"	2-3/4"	included	14 ga. steel	6"	8"	steel	staggered	powdered metal
4.0	rope	3/8"	3/8"	1"	2-7/8"	extra	16 ga. steel	6"	6"	steel	in-line	powdered metal
9.0	recoil	3/8"	3/8"	1/2"	3"	included	16 ga. steel	7"	7"	steel	in-line	powdered metal
15.8	recoil	3/8"	3/8"	1/2"	3-1/2"	included	1/4" aluminum	7-1/2"	7-1/2"	plastic	in-line	powdered metal
4.0	recoil	1"	1/2"	1"	3"	included	aluminum	6"	6"	steel	in-line	nylon
6.6	recoil	1"	1/2"	7/8"	2-7/8"	included	14 ga. steel	6"	8"	steel	staggered	ball
6.4	recoil	1"	1/2"	7/8"	2-7/8"	included	14 ga. steel	6"	8"	plastic	staggered	nylon
4.0	recoil	3"	1/2"	1-1/4"	2-3/4"	included	14 ga. steel	6"	6"	steel	staggered	powdered metal
6.6	recoil	3"	1/2"	1"	2-1/2"	included	14 ga. steel	6"	6"	steel	staggered	powdered metal
6.4	recoil	3"	1/2"	1-1/2"	3"	included	14 ga. steel	8"	8"	steel	staggered	powdered metal
16.5	recoil	3"	3/8"	1"	3"	included	3/20" aluminum	6"	8"	steel	staggered	powdered metal
3.4	rope	3/4"	5/8"	1-1/2"	2-1/2"	included	14 ga. steel	6"	6"	steel	in-line	nylon
6.6	rope	3/4"	5/8"	1-1/2"	2-1/2"	included	14 ga. steel	6"	6"	plastic	in-line	nylon
6.0	recoil	3/4"	5/8"	1-3/16"	3"	included	14 ga. steel	7"	7"	plastic	staggered	nylon

[d] minimum thickness
* mail-order catalogue price; freight extra

(in "list price") by as much as $10 or even $15.

Mechanically, the news is this:

• Starters. A new and cheaper electric starter comes (as an extra) on eight makes of mowers using Clinton engines. Built by GE, it is a simple induction motor (one moving part) permanently attached underneath the mower. Big advantage: price ($15 to $20). Other makers also offer electric starters but these are series motors (involving brushes and commutators), usually cost twice as much as the GE-Clinton attachment. Another starter development is a foot crank (Bolens)—you kick down to yank the cord.

• Guards. The rotary mower is a notoriously toe-hungry machine, and a grille underneath the blade seems an obvious and sensible idea. This year Choremaster has one. Look for others to come.

• Size. The 18-inch mower is still the most popular, but more and more people are buying bigger models. A few makers expect to sell more 21-inchers than 18s this year, and riding mowers are gaining fast, too.

What's coming? Most improvements in power mowers over the past few years have involved the *mower* part of the machine—housing, wheels, cutting blade. Redesign of *engines* and *engine accessories* is due. Two points are getting concentrated attention right now: starting and noise.

Starting. Clinton (which makes engines only, not mowers) is pushing starter research hard. Besides the little GE electric starter mentioned above, which is now available, it has demonstrated an experimental "impulse starter."

This is a neat and simple gimmick: a spring that you wind up with a handle. When you press the release button, the spring cranks the engine. Winding the spring takes only a third to a fourth as much effort as turning over the engine with a rope—and you can do it slowly. When the spring unwinds, it cranks the engine twice as fast and twice as long as a hard pull on a rope does, which makes for surer starting.

No price or marketing date has been set for the impulse starter, but it is likely to cost almost as much as the little electric job. Its big advantage: convenience. You can use it anywhere, even when you're chopping weeds on the back 40, far from an electric outlet.

Still another starter is rumored (reliably, but without official confirmation from Clinton) to be ready for introduction by summer. This one uses gas pressure from a little capsule of compressed carbon dioxide (the kind that puts the fizz in home soda syphons). You insert the capsule in the chamber, pull the trigger, and the expanding CO_2 spins the engine. The idea is borrowed from early airplane engines, which used expanding gas from shotgun shells for starting.

Noise. The mowers' roar is a steady background, morning to dark, for outdoor living in every suburb. As soon as one neighbor kills his machine, another starts his. And when you're at the handle of your own, it drowns out every word that isn't shouted into your ear.

What can be done? Several of the powers in the business are deep in costly research programs. They report that 50 percent of the noise comes from the exhaust, 35 percent is air whistling through the intake and the remaining 15 percent represents the clatter of moving parts.

Bigger, more effective mufflers (for exhausts) and silencers (for intakes) are

[*Continued on page 242*]

YOU KICK TO START some of the new Bolens machines. The foot pedal (Bolens calls it Step-O-matic) is a simple crank gripping the handle of the standard type of rewind starter.

LOW-COST ELECTRIC STARTER is offered on some mowers using Clinton engines. Press switch goes on mower handle, starter motor is mounted between the blade and the engine.

SAFETY GRILLE covers rear three-fourths of blade on Choremaster machines. Openings let grass through while keeping all-too-easily-harmed feet away from danger of spinning blade.

FOLDED UP, tiny new flash can fit in a shirt pocket. Dial on back quickly shows the correct camera setting to use for any bulb, film and distance.

No-Battery Flash Generates Its Own Power

A TINY new flashgun that never needs batteries and takes up no more space than a pack of cigarettes will go on sale for the first time this month.

It uses no power packs, chargers or other outside current. You simply insert a flashbulb, spin a small wheel and a miniature built-in generator stores an electric charge in a capacitor. When you trip the shutter, the capacitor lets go its charge and fires the bulb.

Half a turn of the wheel is enough to fire the bulb, although as many as 50 volts can be built up on several spins. If you decide not to shoot immediately, the capacitor holds the charge for about five minutes. Any of the standard M-2, No. 5 and N-25 bulbs can be used.

How long will it last? Barring breakage, Eastman Kodak, its maker, says there's no reason why it shouldn't continue to operate indefinitely.

Two models of the new flash are available, one with special pin connectors for some Kodak cameras for about $14, and one with a standard shoe mount for about $15 that will fit other makes. A similar pocket-size flash, using penlight cells instead of the generator, is also available for about $8.

what's new

for your car

A self-gapping spark-plug is said to produce a clean, hot spark without ever needing adjustment. The spark starts arcing at the point of least resistance around the rim of a circular electrode (above, at right). As the gap widens, the spark keeps jumping to new points around the rim, always maintaining the proper gap. Made by Ful-Power Corp., the plugs are available in sets of six and eight for about $10 to $14 for each make, model and year of car.

Tire-valve caps with built-in pressure indicators tell you at a glance when your tires are too soft. As soon as pressure drops three pounds, a red button drops out of sight in the end of the cap. Practical Products sells five caps, preset to your desired pressure from 22 to 90 pounds, for about $4 . . . ***You can spot traffic lights better*** with a Lucite plastic prism that attaches to the top of your windshield and gives you a wide-angle view upward. It's made by Lite-Site . . . ***The dual-purpose auto wastebasket*** at left doubles as cold-drink carrier on hot trips. The Wooster Rubber Co. sells the waterproof plastic basket for about $2 . . . ***A rear-seat TV set*** that also operates as a plug-in portable on house current is already being tested by Oldsmobile, but won't be available for a while . . . ***A Sputnik-proof garage-door opener*** has been developed by Alliance in answer to the accidental tripping of a Schenectady homeowner's radio-controlled doors by the Russian "moon." Only the right combination of radio frequency and pulse signal will open the doors.

for your home

Want the moon? You can have it—or nine other celestial scenes—in blowups big enough to wallpaper a room. Astro Murals, including sun, stars and planets, are available on paper or cloth for pasting to a wall, or as transparencies for backlighting. Sizes range from 2′ by 3′ for about $6 to 6′ by 8′ for about $34 . . . Returning to earth, NuTone has a new ***built-in bathroom scale*** that folds out of the way between wall studs when not in use. You can install one for about $35 . . . Another NuTone newcomer is a ***room-to-room wall fan*** (something like the kitchen exhaust type) that helps distribute heat or cooled conditioned air between rooms. Price is about $22.

Two new wall coverings: Marlite's ***plastic-faced hardboard paneling*** is now available in a perforated type for use with today's popular hook-on fixtures. You can get it in nine colors and many woodgrain and marbleized patterns with 1″-spaced holes . . . ***New flexible tiles*** (bottom, right) add both heat and sound insulation to a room, as well as a fancy decorative effect. Made of a thick, spongy new plastic developed by Curtiss-Wright, the 10″ squares come in 12 colors, require only adhesive for mounting, cost about 33 cents apiece . . . ***A hot-water dispenser*** for quick cups of coffee or tea (below left) is being tested by Youngstown. The electrically heated unit, designed to fit under a kitchen sink, will keep a half-gallon of water piping-hot all day long. It is expected to sell for about $70.

More new products on the next page

what's new for the home shop

You can add more than 30 different attachments to the ratchet driver shown at left. The 1/4" drive takes a full series of socket wrenches, both regular and Phillips screwdriver blades, extension shafts, T handles, spin handles, and a universal joint. The basic Herbrand driver with one bit sells for about $6 . . . ***A screwdriver with a built-in socket wrench*** in the handle is made by Vaco Products so you can get at those pesky, slot-less screws found in radio and TV chassis.

Magna has come out with a ***new economy-priced multipurpose Shopsmith*** for $179.90—approximately $100 less than its big brother. Chief cost savings: three-speed pulley instead of continuous speed changer, single right-hand quill feed, slightly shorter length and smaller work table. Other changes include simplified adjustments and a one-piece outboard fence-support . . . ***Want a free propane torch?*** You can get one as an extra prize by entering the big Home Improvement Council Contest through POPULAR SCIENCE. Use the form printed elsewhere in this issue to obtain an entry blank or pick one up at a participating hardware or building-supply dealer. In either case, be sure to return the completed entry direct to POPULAR SCIENCE. The Bernz-O-Matic torches will go to the first 500 to get their entries in.

for the home handyman

"Nail-on bricks" will soon be available in large sheets (left) that go up fast without the work, weight and cost of real brick. Developed by Redibrick Industries, they're actually thin strips of masonry bonded to panels of insulation board, which together serve as both sheathing and siding . . . Another new ***insulated siding*** is Alsco's aluminum "clapboards" backed with a 3/8" layer of plastic foam. Prepainted in a variety of baked-on enamel colors, they're said to reduce heat loss, end rot, and last indefinitely . . . ***New aids for trash cans:*** Ecco makes a wheeled bracket that clamps to the bottom of a heavy can for easy rolling. Two other accessories turn an old 55-gallon oil drum into a king-size rubbish bin. Witt Cornice Co. supplies a self-closing, hinged top and a wheeled base; you supply the drum . . . ***You can check the balance of a mower blade*** by placing it on a plastic cone made by Akay. If the blade tips, you file down the heavy end until the blade is correctly balanced to prevent damage to the crankshaft.

for more information:

Here's where to write if you can't get any item listed above: **Akay Corp.,** *4034 N. Kolmar Ave., Chicago 41;* **Alliance Mfg. Co.,** *Alliance, Ohio;* **Alsco, Inc.,** *Siding Division, Akron, Ohio;* **Ansco,** *Binghamton, N. Y.;* **Astro Murals,** *231 W. 58th St., NYC 19;* **Bar-B-Kwik Co.,** *P. O. Box 9146, Long Beach 10, Cal.;* **A. G. Busch & Co., Inc.,** *6122-38 N. Northwest Highway, Chicago 31;* **Curtiss-Wright Corp.,** *Curon Division, 50 Rockefeller Plaza, NYC 20;* **Eastman Kodak Co.,** *Rochester 4, N. Y.;* **Ecco Equipment Corp.,** *2359 N. 6th St., Philadelphia 33;* **Edmund Scientific Co.,** *Barrington, N. J.;* **Filner Products, Inc.,** *101 W. 31st St., NYC 1;* **Ful-Power Corp.,** *Indiana Theatre Bldg., Indiana, Pa.;* **Herbrand Tools,** *Fremont,*

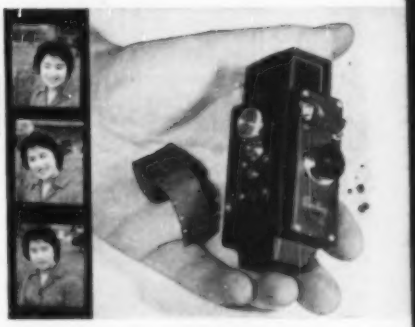
A spray can with a built-in bellows (at right) makes it easy to squirt powdered graphite under pressure into locks, hinges and other hard-to-reach spots. The refillable plastic container is sold by A. G. Busch for $1.25 . . . ***Metal brackets for mounting rural mailboxes*** are available in two types from Macklanburg-Duncan for about $1.50. One joins a box to a four-by-four wood post; the other fits a 1½″ pipe support.

just for fun

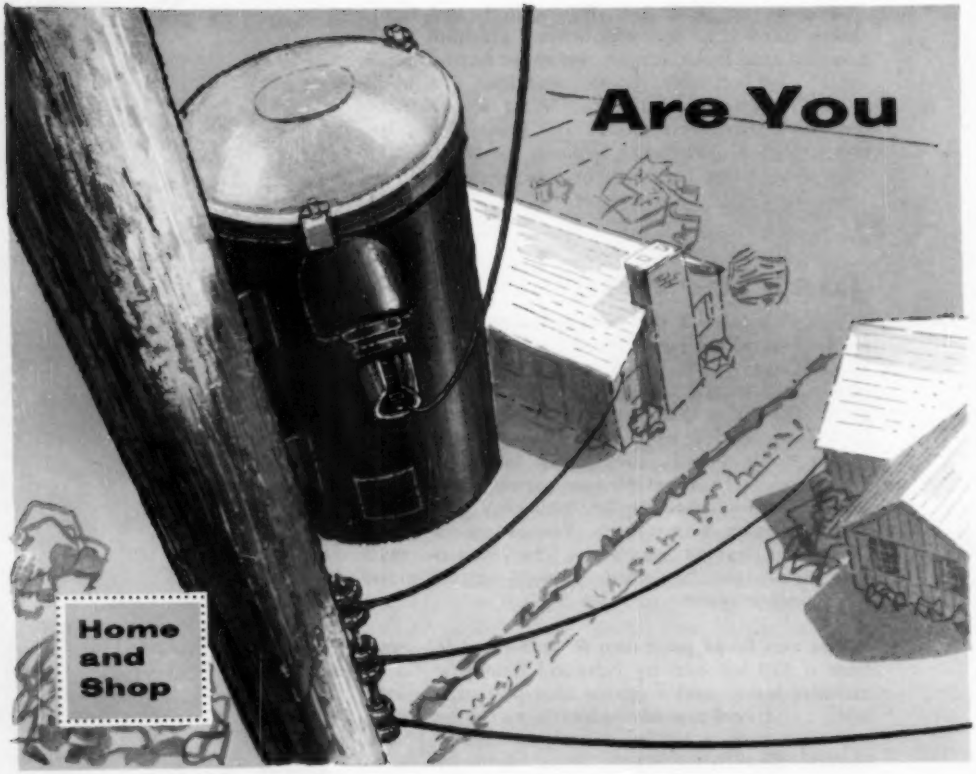
You can have a ***two-pound, portable tape recorder,*** shown at right, for $26.95. Imported from West Germany, it has a transistor-powered amplifier and runs 15 hours on four flashlight batteries. The "fi" is definitely not "hi" but is adequate for voice recording at parties and on vacation trips. Filnor Products sells it with mike, headphones and tape spools . . . ***An electronic organ with its own built-in record-changer*** lets you play along with music or instruction records. You can also play the four-speed changer separately. The Thomas organ, with two-octave keyboard, 20-watt amplifier and four-speaker system, sells for $795.

You can build your own 6″ reflecting telescope from a $12 kit sold by Edmund Scientific Co. It includes lenses and a mirror that you grind yourself . . . ***A rechargeable electric razor*** for camping trips runs a week on one overnight 115-volt charge. The Royal-Matic shaver sells for about $30 . . . For quick cookouts, there's a ***disposable barbecue*** consisting of prewrapped packets of charcoal that fit into a collapsible wire stand. Each Bar-B-Kwik packet and stand costs $1.25 . . . Eastman Kodak's fancy new ***automatic slide projector*** flips on a fresh scene every four, eight or 16 seconds and can be backed up manually to any previously shown slide. Price is about $150 . . . ***The miniature fixed-focus camera*** at right takes 12 snapshots on standard 16-mm. movie film. Silver Bells imports it from Japan for about $10 . . . ***The fastest indoor color film,*** a tungsten version of Ansco's Super Anscochrome, is now available in 120 and 35-mm. rolls. It has a whopping exposure index of 100.

Sheldon Galtzer



Ohio; **Lite-Site Corp.,** *P. O. Box 21, Tonawanda, N. Y.;* **Macklanburg-Duncan Co.,** *P. O. Box 1197, Oklahoma City 1, Okla.;* **Magna Power Tool Corp.,** *Menlo Park, Cal.;* **(Marlite Paneling) Marsh Wall Products,** *Dover, Ohio;* **NuTone, Inc.,** *Madison & Redbank Rds., Cincinnati 27;* **Oldsmobile Division,** *General Motors, Lansing 21, Mich.;* **Practical Products Mfg., Inc.,** *6566 W. 83th Pl., Los Angeles 45;* **Redibrik Industries,** *351 Ottawa Ave., Holland, Mich.;* **Royal-Matic Shaver Co.,** *5541 S. Ashland Ave., Chicago;* **Silver Bells Ltd.,** *7637 Del Monte Blvd., Seaside, Cal.;* **Thomas Organ Co.,** *Division of Pacific Mercury Corp., Sepulveda, Cal.;* **Vaco Products,** *317 E. Ontario St., Chicago 11;* **Witt Cornice Co.,** *2110 Winchell Ave., Cincinnati 14;* **Wooster Rubber Co.,** *Wooster, Ohio;* **Youngstown Kitchens,** *Salem, Ohio.*



By Erik H. Arctander

A FRIEND of mine heats his vacation cabin electrically with radiant panels. After five trouble-free years, the glass in two of his three panels shattered within a week's time.

Another friend's wife complained that her new washer didn't spin clothes dry enough. One morning, when a heavy load was spinning, wisps of smoke and a burning smell drifted out of the machine. The repairman prescribed a new motor.

In neither case was the electrical equipment at fault. Over-voltage wrecked the heat panels, under-voltage burned out the washer motor. The over-voltage was caused by a hike in the power company's system voltage. The under-voltage was caused partly by undersize house wiring, partly by low power-line voltage.

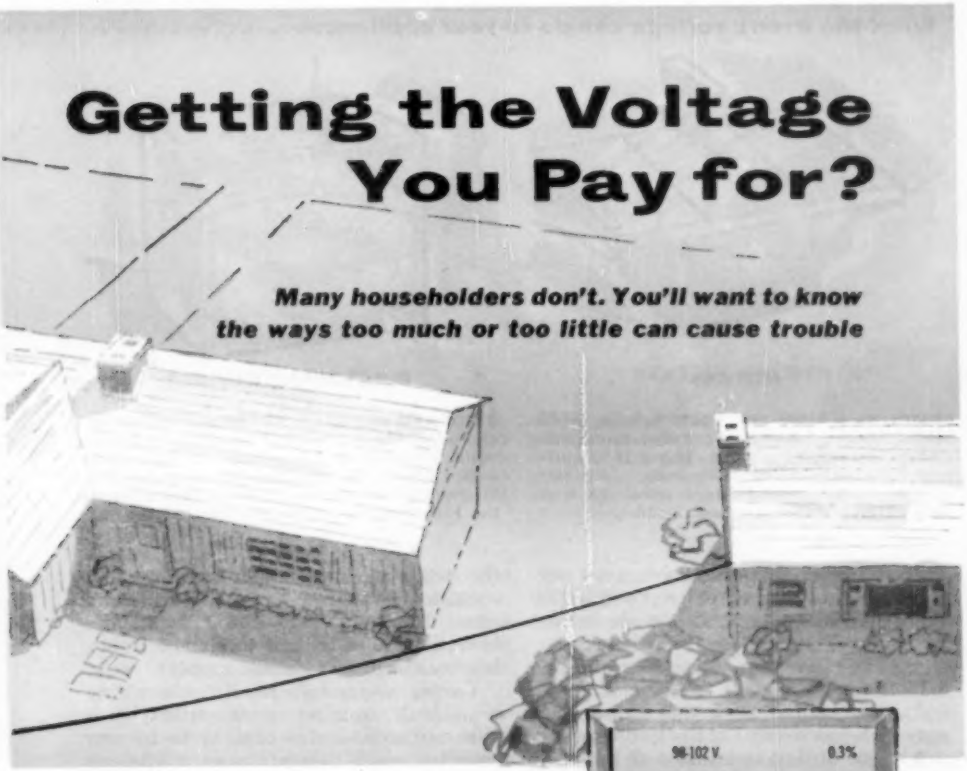
How could such things happen? These expensive accidents made me wonder what power companies and appliance makers could tell me. Are they working together to see that we get long and efficient use from electric appliances?

The first thing I discovered was that 110 volts is rare in homes today. For the past 30 years line voltages have been creeping upward. Lack of a firm standard has been one cause; power-company economics, another. The economics is simple: Higher voltage lets you push more power over the same lines. The alternative is an expensive new transmission system.

Putting a lid on volts. In 1949, the Edison Electric Institute (representing utilities) and the National Electrical Manufacturers Association (appliances) got together to standardize voltages. The joint committee chose 120 volts as the ideal residential voltage to aim at. Deviations, inevitable in power distribution, were to be kept within a "favorable zone" —between 110 and 125 volts.

Getting the Voltage You Pay for?

Many householders don't. You'll want to know the ways too much or too little can cause trouble

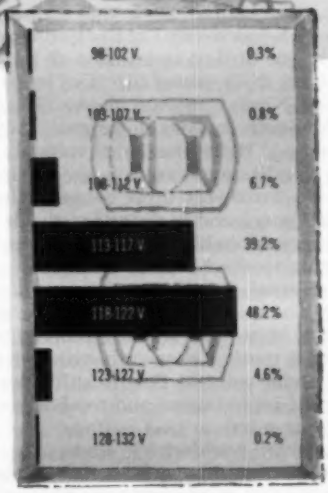


Unofficial estimates by experts in the power field indicate that a large majority of all U. S. wired homes are thus supplied. The number will increase as old power-company equipment is replaced.

The same joint committee decided on design voltages for each type of electrical device. If an appliance doesn't get exactly the voltage it's designed for, performance won't be ideal. But within 10 percent (plus or minus) you may not notice the difference. A bigger spread than 10 percent can cost money, cause trouble.

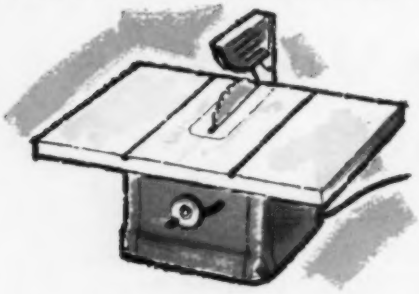
Proper nourishment of your electrical equipment depends on several things:

- What nominal system voltage the power company maintains.
- Whether you live in a large city or in a suburban-rural area. The largest cities have "networks" whose cross-connections ensure steadier voltage than the usual radial systems.
- Whether you live in a commercial or



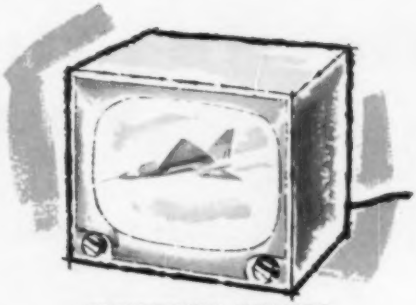
WHAT VOLTAGE HOMEOWNERS ACTUALLY GET is indicated in these results of a survey by General Electric's TV Receiver Dept. Wall outlets in 13,000,000 homes, supplied by 64 different power systems, were meter-tested. Survey shows that an overwhelming 87.4% of homes tested have between 113 and 122 volts; the once-standard 110 volts has almost vanished.

What the wrong voltage can do to your appliances



MOTORS

RATED AT A LOW 115 VOLTS because under-voltage with a heavy load can burn the winding insulation, ruining a motor. Just a 10% under-voltage (103½ volts) saps starting and running torque by 19%. Moderate over-voltage is not serious, it merely increases the torque.



ELECTRONIC DEVICES

RATED AT A MEDIUM 117 VOLTS because under- and over-voltage are about equally bad. Under-voltage shrinks a TV picture (a 10% drop causes a 10% shrinkage in picture area), cuts brightness, sensitivity. Over-voltage shortens the life of picture tube and vacuum tubes.

industrial section served by heavier wiring. Good at night, maybe not so good by day when flickers and surges are caused by heavy changing loads.

- How close your house is to the line transformer serving it. Voltage is apt to be above normal near the transformer, may be below normal at the line's far end.
- Time of day and season of the year. Heaviest daily power use: five to 10 p.m. In the North, demand peaks in winter; in the South it peaks in summer (air conditioners). Heavy loads cut voltage.
- Condition of your house wiring. A two- to three-volt drop between the entrance panel and a distant outlet is considered reasonable; more of a drop indicates undersized branch wiring.

Uniformly poor performance from your lamps and appliances is the surest tipoff to improper voltage. Dimming bulbs, laboring motors, slow-acting heaters indicate under-voltage. Bright bulbs needing frequent replacement and too-hot heating elements point to over-voltage.

You can doublecheck under- or over-voltage symptoms with an AC voltmeter. Plug the test prods into a wall receptacle and read the line voltage. Remember, though, that small meters can be from two to five percent off. And one reading probably won't be typical; better take a series spread through the day.

The remedy for over-voltage rests with the power company. Wall outlets that consistently deliver over 120 volts are cause for complaint. Power companies have been held liable for damage resulting from improper voltage supply.

Curing under-voltage, if house wiring is at fault, usually means putting in a new entrance service plus 12 to 16 new branch circuits. There's a much cheaper stunt that may work almost as well. Run one extra-heavy line (a "sub-feed") from the existing entrance service to a new panel box near the main current users—usually this means the kitchen.

Each major kitchen appliance is wired, on its own individual circuit, to the sub-feed panel box. So is a cluster or two of wall outlets for small portable gadgets. This relieves the original circuits of all but lighting duties. Voltage drop at the appliances is small because of the heavy subfeed wire and the short runs on each appliance circuit.

You can carry a second subfeed to the top floor, too, if air conditioners, attic fan and bathroom heaters are piling on a heavy load. One builder actually wires new houses with two entrance panels—one in the kitchen, another in the bedroom hall. Each panel box supplies both 120 and 240 volts.

Without any new wiring you can still prevent an appliance motor from burning up. Most motors come with a thermal cut-

LIGHT BULBS

RATED AT A HIGH 122 VOLTS because over-voltage burns them out quickly—a voltage 10% too high slashes bulb life by 70%. But 10% under-voltage lops 30% off the light output of an incandescent lamp. Fluorescent tubes are not so much affected by improper voltage.

HEATING ELEMENTS

RATED AT A MEDIUM 118 VOLTS because over- and under-voltage both cause problems. Too much dangerously overheats radiant heaters, broilers, toasters. But 10% under-voltage cuts heat output roughly 19%; thermostat-controlled devices just take longer to reach working heat.

out attached to the case; this opens the circuit if windings draw too much current. Motors lacking a cutout can be plugged into special outlets with a replaceable fuse inside. These inexpensive outlets are easily installed.

When power-company service is suspect you can find out by asking the utility to hook a recording voltmeter on the entrance service. The instrument makes a continuous voltage record for several days. Spot checks might be misleading because of temporary load variations.

What the utility company can do: The power company has simple antidotes for local cases of poor voltage. One of the simplest is to shift taps on the transformer serving your line. Most pole transformers have four 2½-percent taps—two below and two above the system voltage. Changing taps can drop or boost your voltage either three or six volts, roughly.

Where under-voltage can't be remedied this way, the utility may install shunt capacitors or supplementary voltage regulators on the line. The next, most drastic, step is to build more feeder lines to divide the load into smaller pieces.

What you can do: Service-minded companies take random load readings on their branch lines when on jobs in a neighborhood. But if service calls are infrequent, big load jumps may go unnoticed. You can help by notifying them when an electric range, central air conditioner or other heavy current-user is added. A load increase of 5,000 watts or more should be reported.

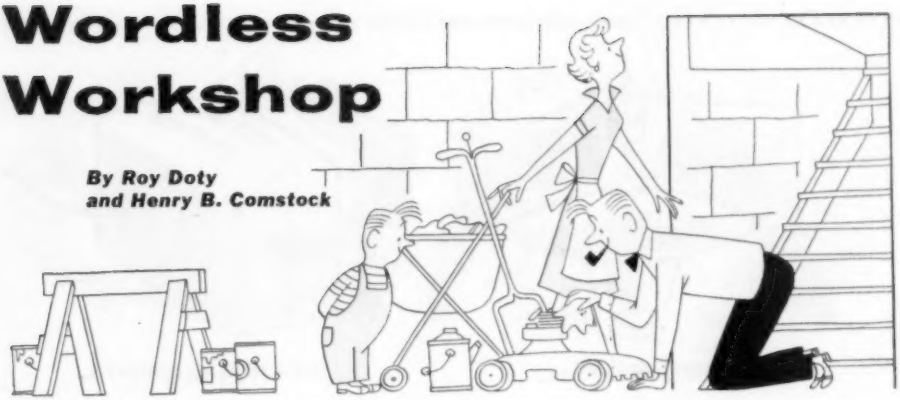
It pays, too, to locate your transformer by following the power line back to it. Many pole transformers have a red light that goes on when a momentary overload hits the line. It stays on until shut off by a service man. If the overload persists, a circuit breaker cuts all power. So a call to the company when you spot a red transformer light can often prevent an "outage" and improve voltage supply to your house.

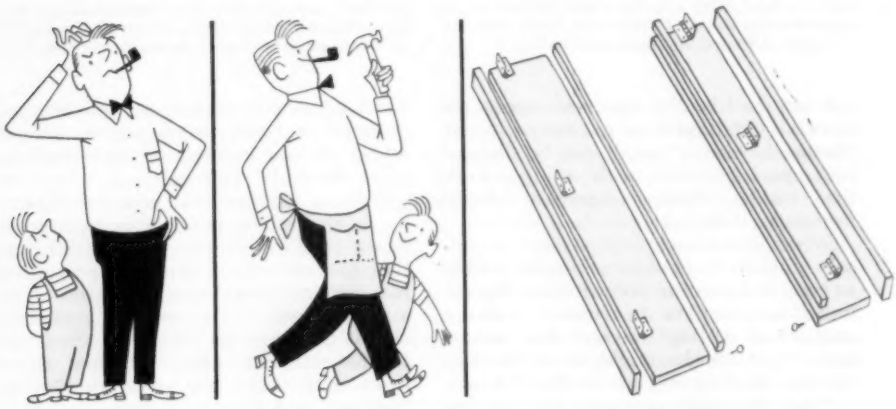
Voltage changes. Sometimes quality of voltage supply suddenly improves or deteriorates. A flock of new appliances in neighbors' homes can chop some volts off. And service can go either way if the utility rearrangges feeder lines so that you are closer or further away from the transformer. This sort of shuffling is most likely when new houses tap in nearby.

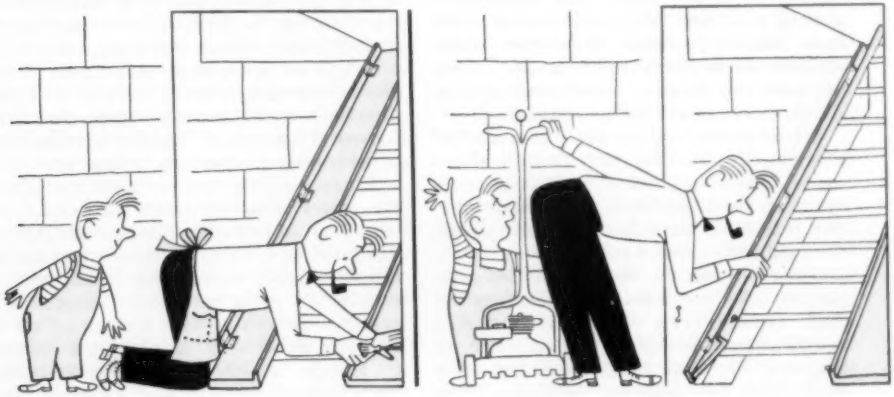
There *is* a way to divorce yourself from the power company's problems. You can install an automatic voltage regulator at the panel box. An auto transformer called Inductrol will supply the house with a steady 120 volts, even if the supply is a nominal 110 volts with swings of up to 12 volts either way. But one big enough to handle a 100-ampere service costs a whopping $870! END

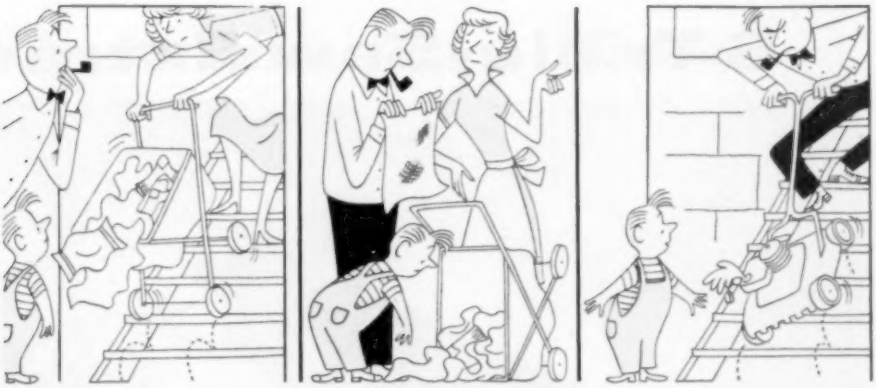
Wordless Workshop

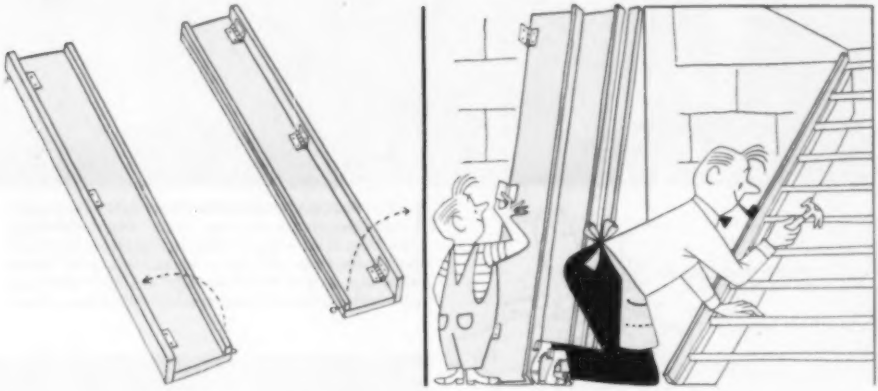
By Roy Doty
and Henry B. Comstock

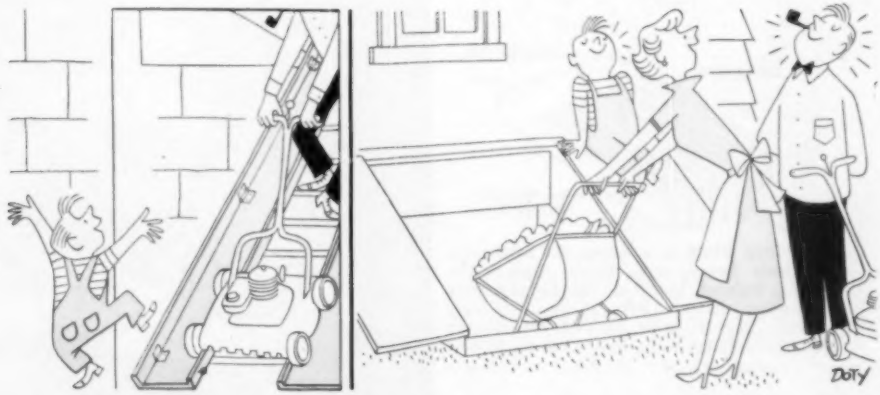






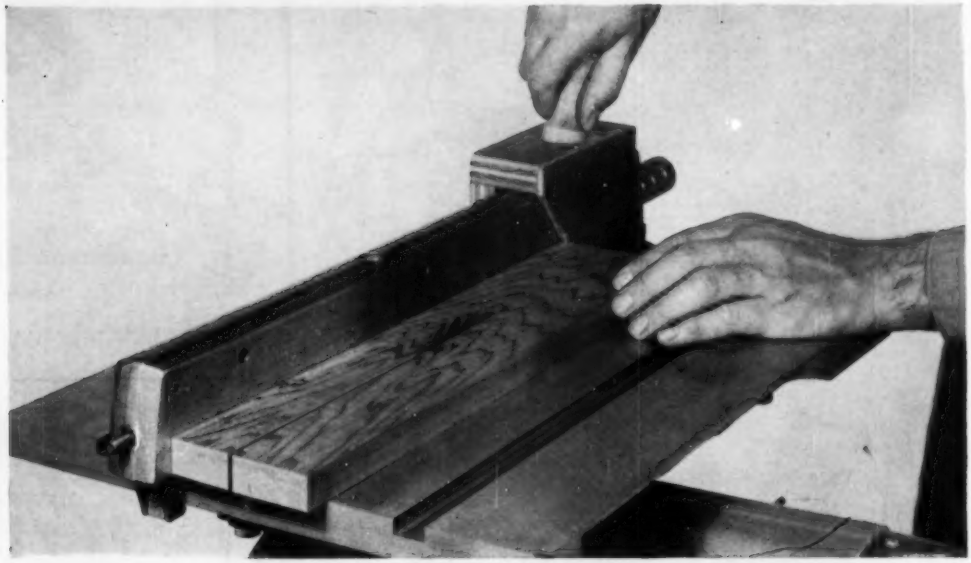




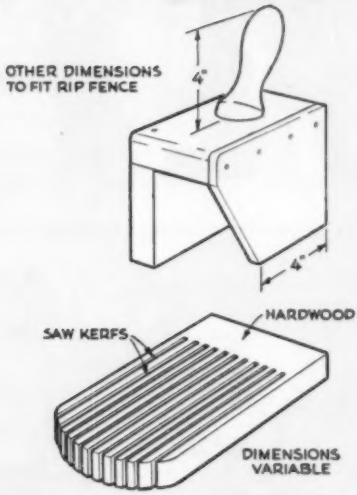


Next Month: A gate-latch alarm to keep kids safely corralled

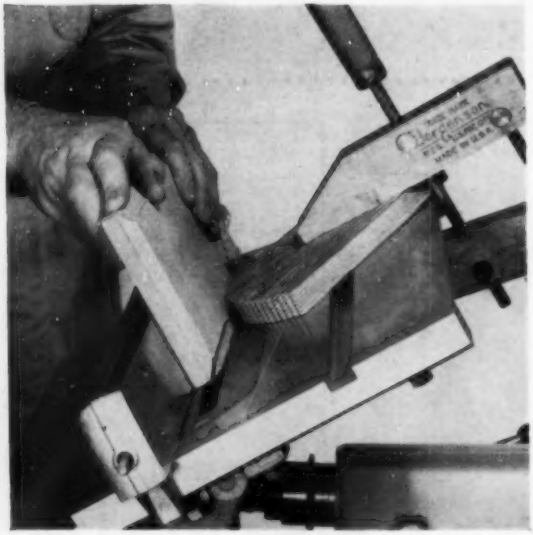
6 Table-Saw Extras



1 RIP-FENCE-STRADDLING PUSH STICK is handy for jointing, shaping and edge-rabbeting (the bias lead edge of the ¼" section prevents the stock from lifting). Make this and other table-saw extras from straight-grained wood or plywood as protection against warping.

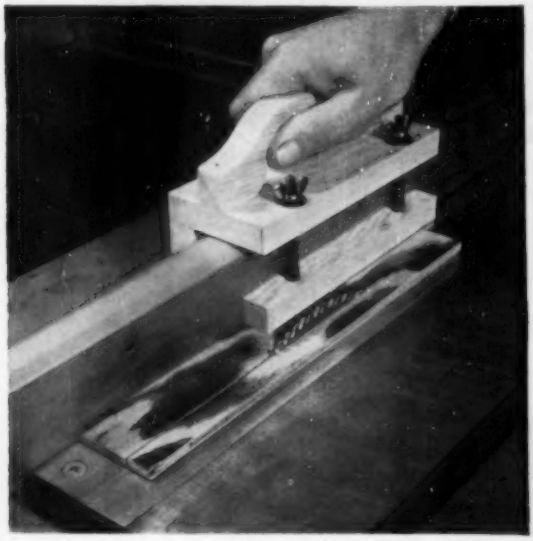


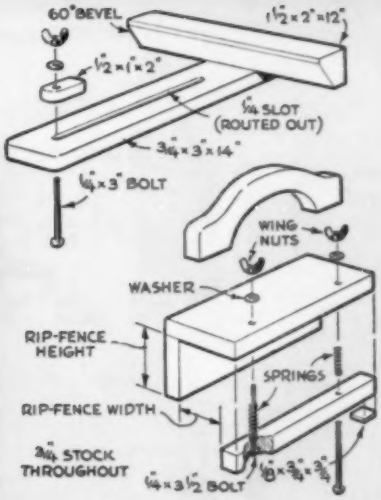
3 SPRING STICK is a horizontal hold-down which forces work firmly against the fence, without binding, for bevel-cutting and other delicate jobs. Make its evenly spaced "fingers" with parallel cuts of the saw, and clamp it to the table as shown.



That You Can Make

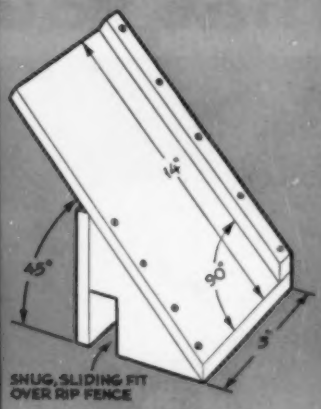
2 CROSSCUTTING GUIDE AND CLAMP holds down large panels and boards the safe way while you advance them into the saw. Make sure that the blade is always pressed firmly against the saw-table edge. Use scrap wood under the clamp to protect stock surfaces.



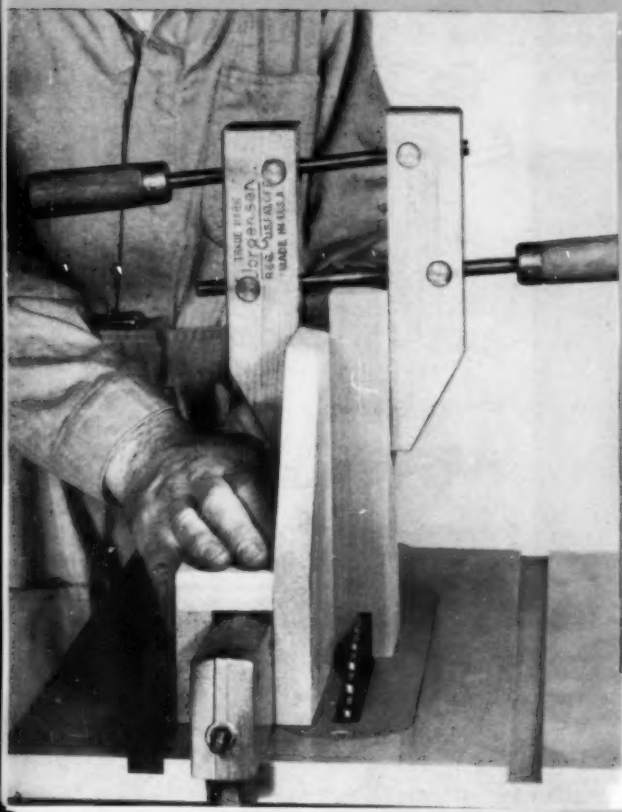


4 SPRING-LOADED HOLD-DOWN is useful for cutting narrow stock, or stock of variable thickness. It can be adjusted to the job by setting wing nuts for proper tension. Use four coats of shellac—the first thinned with alcohol—to finish all table-saw extras.

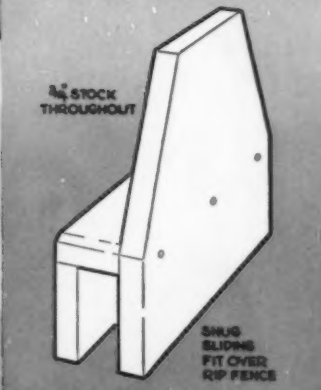
Please turn the page for more table-saw extras



5 CROSS-MITER JIG. If you have a bench saw with a tilting table, this jig will save you the inconvenience of loosening and realigning it for 45° cuts. Clamp stock trimmed to size on the jig, which straddles the fence, and push the whole unit past the saw blade.



6 SLOT-AND-TENON JIG provides a firm support, to which work can be clamped vertically for end cuts. Use this handy accessory either with a dado, or with an ordinary blade and a rip fence, resetting the fence as often as necessary to provide the right slot width.



Want to slash building costs? Then be your own contractor. Here's how:

You Can Pocket the Contractor's Profit

By John L. Springer

MUSCLE can build a do-it-yourself house, but the labor costs you save won't necessarily make it the best bargain. A survey by a maker of pre-cut lumber reveals that people who shop for the best prices in *materials* and in *hired* labor actually may come out ahead of the do-it-all-yourselfers.

That's what I did. By acting as my own contractor I made about eight dollars an hour—far more than I could have made working as my own carpenter.

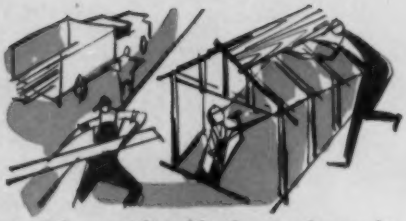
Here's an example. The first men I consulted asked from $2,300 to $2,800 for the plumbing work. I took a day off, got other bids. The result of my one day's work—getting a new estimate of $1,800—saved enough to pay a carpenter for a month.

Here's how I saved money—and how you can follow suit.

Hiring sub-contractors. Look around for specialists. Among carpenters, for instance, you will find workmen who do

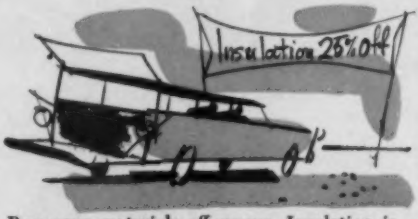
To save money as your own contractor, plan your work

You may be smart with a hammer, nails and a saw, but using brawn instead of brain doesn't build the best house. Why earn your home in the sweat of your brow? Here are ways of getting the job done with fewer dollars—and fewer calluses on your hands.



Look for specialists, like these workmen who put up dormers expertly and fast.

Schedule your work so that each expert can go right on the job without wasting time.



Buy your materials off-season. Insulation is cheaper in the summer, lumber in winter.

one specific job better, faster, and cheaper—such as installing dry walls and ceilings, laying oak floors, putting in locks and other hardware, building stairs, installing garage doors, weather stripping and windows.

There is the case of my neighbor who hired one carpenter to do the whole job of finishing off an attic. Getting his gypsum board into place on walls and ceilings cost 11 cents a square foot. The jack-of-one-trade that I hired charged only a nickel a square foot.

Anyone building a new house can easily locate contractors who do good work at reasonable prices. Drive around until you find construction being put up by a man who has a reputation for building good houses at low cost. Note the names of contractors on signs nailed in front or on the trucks. That's how I ran across a stair-builder with a shop about 25 miles away whose estimate was 35 percent lower than that of a local man.

Many home builders hire labor by the day. Whether you can save by doing this depends on how competent the workman is. If you have to stand over him all day to make sure he won't goof off, it's not worth it. My experience was that it's better to hire a contractor to do a job at a fixed price. The clincher was when I hired a crackerjack mason by the day. Half the time he was mixing mortar, lugging concrete blocks and doing other jobs that could have been done by a laborer making half as much. A contractor would have earned his profit by seeing that the mason did only the skilled work.

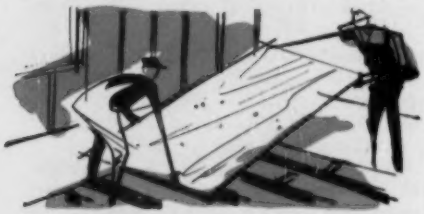
Borrowing money. Like most home builders, you probably will have to arrange for a building loan from a bank to pay for labor and materials as your house is being built and before you get a permanent mortgage.

In my case the bank agreed to make payments at various stages of construction—after the foundation was in, when the roof was on, after rough utilities were installed and the inside walls could be put up, when I was ready for interior painting, and when the "C.O."—certificate of occupancy—was issued stating that the house was safe to live in. The bank charged a hefty interest rate—one half of one percent a month—from the moment it made each payment. But you don't have to request a payment until you need the cash. You can wait for payments until the end of a month, and then pay your bills before the 10th of the following month, taking advantage of the two-percent cash discount allowed by most suppliers.

Scheduling work. Every day's delay in work cost me about $3.00 in interest

Pay for the *job*, not by the *hour*, so a skilled man won't draw high pay for common labor.

Borrow from the bank only as you need the money. Interest payments can pile up.



Use labor-saving material such as four-by-12-foot plywood panels. Watch hourly costs.

Store materials out of sight, under lock and key if possible. Don't risk thieving.

charges and taxes. That makes it important that contractors come in, do their jobs, and get out with the least delay.

After a house is rough-framed and studs for the interior partitions are in place, the plumbers, electricians and heating men can pile in. After they complete roughing-in for utilities, the insulation goes into place, and then you're ready for plasterers or wallboard installers. Get commitments from contractors as to when they can come on the job and when they can leave. That lets you make up a work schedule to save time and money.

This sounds easier than it actually is. To be on the safe side, allow leeway at both ends. Say the electrician promises to begin work on a Monday and says that he will need three days to do the rough wiring. Figure that he might come a few days late or take longer. Therefore it is best to schedule the next step—installing the insulation—for a week or so after the electrician says he will start.

Actually there were only nine major stages that I had to keep in order: 1, the foundation; 2, rough carpentry, which ended with the roof on and interior partitions up; 3, roughing-in of utilities (electricity, plumbing, heating); 4, insulation; 5, interior walls (gypsum wallboard or plaster); 6, laying the finish flooring; 7, tiling bathrooms; 8, decorating inside; 9, finishing installation (toilets, light fixtures, heating registers, etc.). Most of the other jobs—laying the driveway, painting the outside, installing gutters and leaders, etc.—can be done at any time.

When I tell other home builders that I had no serious trouble with contractors, they shake their heads in disbelief. I've heard of houses lying idle for weeks waiting for a heating man to do an hour's work so that the plasterers could follow him up. All I know is that keeping in touch with the contractors—and being reasonable about minor delays—worked out for me.

Buying materials. The design for my house came from a plan book. It was produced by a top-notch registered architect who sold four sets of blueprints—the number required—together with a specification sheet and a list of materials, all for $35. Dozens of architects sell plans by mail for about the same price.

One surprise was when I found that I could buy construction lumber, shingles and other materials for a single house at prices only a little higher than those paid by builders of 50 or 100 houses at a clip. There is quite a bit of competition for an individual's business. (Why not? My lumber bill was about $6,000.)

Incidentally, big lumber shops pack a truck to make the lumber easy to han-

Next Month: *The fourth article in Popular Science's series* Before You Buy or Build *will give you the facts and figures on prefabs.*

Prefabricated houses offer you choices from cottage to mansion. Before you buy or build, you will want to know about them. What are the advantages and disadvantages of each type? What are the specifications to look for? In May, Popular Science will answer these and many other questions about one of the most exciting developments in home building.

dle. Floor joists and sub-flooring that you will use first are on top of the pile, two-by-fours for wall studding are next and ceiling joists at the bottom. When lumber is stacked properly you can save half a day's work of sorting it and digging out the pieces you need first.

It is better to underestimate than to overestimate quantities of materials. I learned the hard way. When my carpenter needed a small piece of two-by-four, did he look for a scrap piece? Of course not. He took a perfectly good eight-foot length and sawed off what he wanted—leaving another scrap. If there had been no long two-by-four around, he would have picked up a smaller piece.

Another saving is to buy materials out of season. For example, insulation and heating equipment are generally marked down as much as 25 percent in the summer. Cement, lumber and plywood are lower-priced early in the year and gradually cost more as demand builds up during the late spring and summer. If you have the storage space, you probably can cut your house-building bill by several hundred dollars.

Cost-cutting techniques. A contractor's bidding price depends to a great extent on the number of man-hours required. Using materials that need the least amount of time to put up pays dividends.

Some materials do a spectacular job of keeping labor costs low. Plywood panels up to four-by-12 feet, for example, can serve as exterior wall and roof sheathing and sub-flooring. My carpenter told me these big plywood sheets cover an area in half the time required to install one-inch by six-inch boards.

Plywood, hardboard or other panels used as both exterior wall sheathing and finished outside wall surface also save a carpenter half the time he would take to put up sheathing and then double back with shingles or siding. Many builders are using a combination roof-deck material that serves as finished exterior roof surface, insulation and finished interior ceiling surface.

Before beginning work, sit down and figure out ways to keep costs low without sacrificing quality. One man I know, planning to use wall-to-wall carpeting, laid ¾-inch plywood as sub-flooring and by-passed the finished flooring. The saving by using only sub-flooring just about paid for his carpeting. Instead of using expensive tile on the walls of his bathroom, he used a good grade of plastic-surfaced wall paper.

Safeguarding materials. Some professional builders write off 10 to 15 percent of material cost to loss and pilferage. If you store lumber, cement and other supplies outdoors, it's almost certain that a local character will consider it his privilege to put together his own remodeling project with your stuff. The only way to beat chiselers is to get everything out of sight. Put doors on the garage as soon as possible and store materials there. A basement is another good hideaway.

Sand and gravel I stored outdoors took another kind of beating. First, youngsters climbed the piles and kicked the stuff all over the lot, then heavy rains washed it into the soil. So: Buy only about a week's supply at a time.

Front and back doors put up so they can be locked at the earliest moment is another safeguard. One neighbor-builder locked those doors too late—after two bathtubs had been stolen.

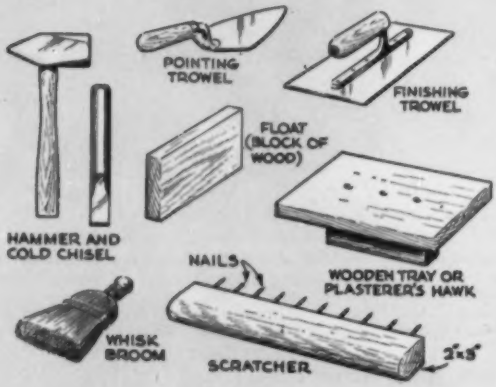
It all adds up. When my house was completed I had appraisers estimate its actual value. Even with my full quota of mistakes, the house cost me 20 percent less than its appraised value. END

Live in a stucco house? Then you'll certainly want to clip and save the helpful repair information on the following two pages. It's part of a series on common household repair jobs appearing monthly in POPULAR SCIENCE.

Next Month: Casement windows.

Popular Science Fix-It File

THE TOOLS YOU NEED



THE RIGHT MIXES

FOR CRACKS
1 part portland cement; 2 parts medium-fine sand. (Add powdered pigment if color must be matched.)

FOR LARGE AREAS
1 part "plastic" portland cement, or 1 part portland cement plus ¼ part hydrated lime; 2½ parts medium-fine sand.

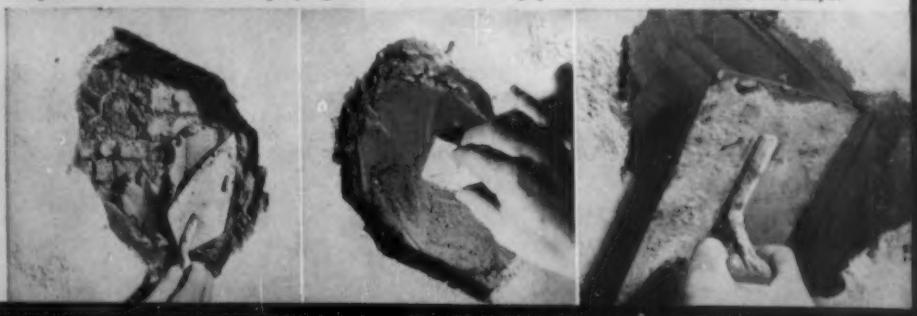
Use this mix for the scratch, brown and finish coat. Add pigment to the last of these three coats.

How to repair cracks

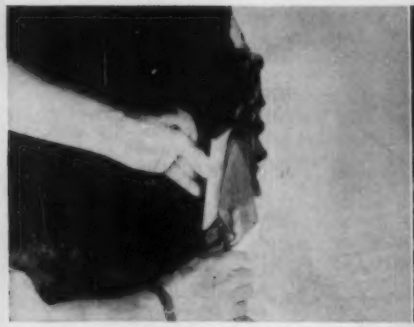
CHISEL THE CRACK OPEN and down to solid stucco, undercutting the edges so new stucco will adhere firmly. Brush out all loose stucco with a whisk broom and dampen area with a fine spray of water. This insures good suction. Press new stucco into crack with a pointing trowel. When it starts to set, strike off the excess flush with the wall surface.

How to patch large damaged areas

CLEAN OUT DAMAGED AREA with chisel and brush, and fog-spray with water. Trowel in a coat of stucco about ¼" thick. When stucco starts to set, roughen surface with a block of wood to insure a good bond for finish coat. Keep moist with occasional spraying for two days; then let cure for a week. Just before applying finishing coat, fog-spray the surface again. Always draw finishing trowel upward, holding it at slight angle shown. Apply firm pressure for complete contact with the undercoat. Keep patch moistened at least two days.



How to make corner repairs



APPLY TWO OR THREE COATS, depending on fill area. Use the wood block to back up one face of each undercoat as you press other face home with pointing trowel. Roughen surfaces of undercoats and let them cure slowly. Apply finishing coat with a large board held firmly against one wall face for a form. Stucco should be as "stiff" as possible—use only enough water for a cohesive mix. Keep finish coat moistened for two days or more.

How to cover windows and doors

FILL IN THE AREA to within ¾" of surface with sheathing nailed to a stud frame. Cover with waterproof building paper, sealing joints with waterproof cement. Apply 1"-mesh stucco-reinforcing wire, using stucco nails (fiber washers hold wire ⅜" away from sheathing). Apply scratch coat, roughening it as shown. Nails in scratcher are about 1" apart.

FOLLOW THE SCRATCH COAT with a "brown" coat, building it out to within ¼" of wall surface. Roughen it slightly with a wood block to insure a good finishing-coat bond.

ON WALLS you'll paint, the finishing coat need not be color-matched with pigment. To match a white-sand stucco finish that calls for no paint, use the same type of sand in the mix.

POPULAR SCIENCE
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No. 8

The know-how you need

When You Paint Your House

Where to find the facts

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Foreword

YOU have prepared the exterior of your house for painting. The scrubbing and scraping and wire brushing are done; so is the replacement of broken window panes, the calking and the puttying. You've removed the screens and shutters, tied back the house-side shrubbery and covered it with drop cloths. Your ladders are in place, and you've purchased your paints, brushes and rollers.

Now comes the actual painting. Will it justify all your preparations? Yes . . . if you follow the simple rules and tips in this booklet. All of them have been tried and proven by professional house painters. Use them to get a triple dividend—results without waste motion, slick appearance, maximum life for your paint job.

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The right weather

In most parts of the country, spring and fall are the best seasons for painting. Paint should not be applied when the temperature is below 50°, on windy days, or to surfaces exposed to direct, hot sunlight. Whenever possible, follow the sun around the house, working on areas that are at least partially shaded. Except when painting masonry with cement-powder or plastic-based paints, surfaces should be completely dry.

If a two-coat job is called for, allow at least three or four days of clear weather for the first coat to dry. Don't count cold or rainy days.

Painting sequence

If a whole house is to be painted, generally the body areas should be done first (shingles, siding or masonry). Trim, including windows, doors, cornices and soffits, comes next. Finish with small parts, such as railings, storm windows, screens and exposed metal work. Start with the highest portions of the house and work your way down in a series of horizontal stretches.

An exception to the rule above applies to houses with high peaks or other hard-to-reach areas. To minimize climbing, break up the usual sequence by painting wall surfaces and trim at the same time—even when you are using two different kinds of paint. You will have to be more careful to avoid running the wet colors into one another and spattering. But you'll save a lot of troublesome ladder-moving and tiring leg work.

If your house is very large, it may be best to spread the work out over several seasons. In this case, paint one or two sides each spring or fall. That way your house will always look fully completed from every angle.

How to mix paint

Your paint store will mix the paint for you, but the heavy pigment settles rapidly and must be reblended with the liquid whenever you leave it for any length of time. Remember that you can't mix paint by simply sticking a paddle into a full can and giving it a twirl or two. Use two containers—the can in which the paint comes and an additional clean pot. Pour most of the liquid from the top of the full can into the pot. Stir what's left with a flat stick until all of the heavy paste has been broken up and no undissolved lumps are left. Now pour back about a third of the liquid and again stir until it is absorbed. Continue pouring and stirring until the original can is full. Next, "box" the paint by pouring it from one can to the other and back again until it's all of uniform consistency.

Finally, pour half of the paint into the extra pot and work out of that. A half-full container is safer to use, and much easier on your arm.

Tips for using brushes

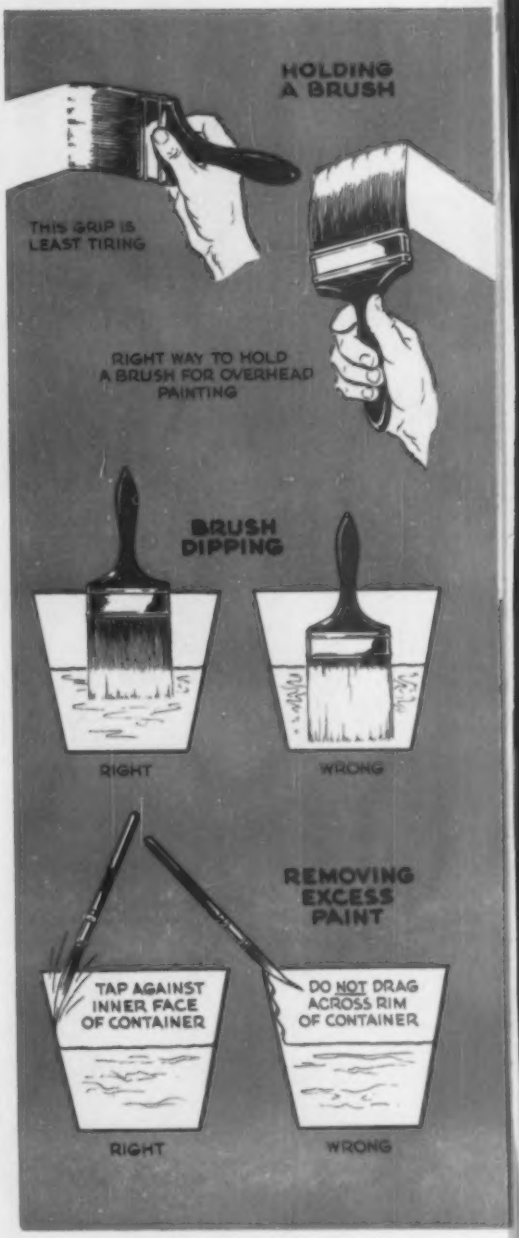
Conditioning brushes. If your brushes are new, take the time to break them in properly. With natural hog-bristle brushes, this means suspending them in linseed oil for at least 12 hours. Hang them from strings, or pass a rod through holes drilled in their handles and lay it across the rim of the container. Letting bristles support the

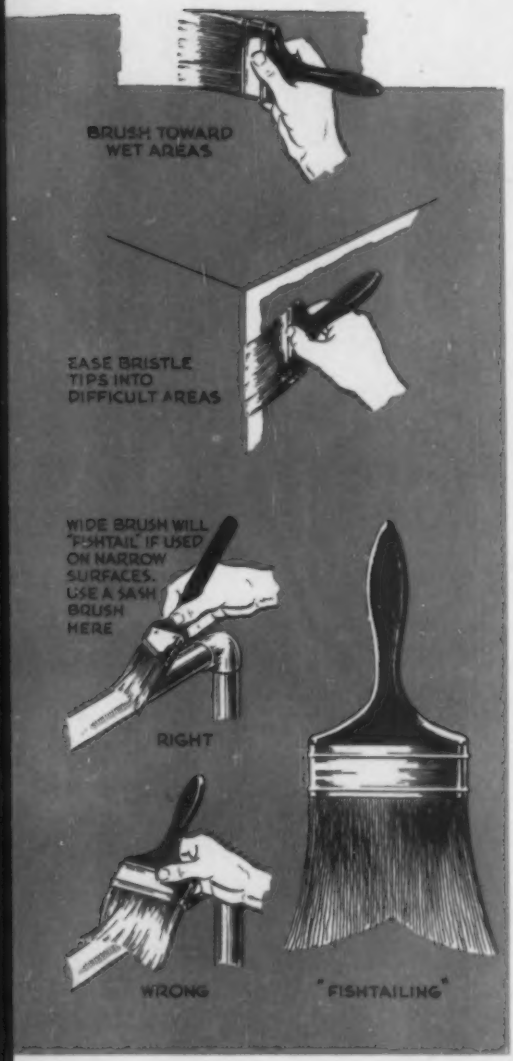
weight of a brush destroys its shape.

After a hog-bristle brush has been conditioned, squeeze out the excess oil. Then, if you're going to apply oil paint, rinse it out in turpentine. For rubber- or plastic-base paint, do the rinsing with soap and water. Nylon brushes do not need to be soaked in oil. Just shake them vigorously to work out accumulated dust and loose bristles; then rinse as above.

How to hold a brush. For best control and minimum arm fatigue, your fingertips should grip the metal ferrule and wide part of the handle lightly. The rest of the handle rests between thumb and forefinger. You cannot, however, conveniently hold a brush this way when you're working overhead on ceilings or overhanging eaves. Here you'll find it best to grip the brush firmly by wrapping your hand around the handle, with your thumb resting firmly on its inside curve where it broadens out to enter the metal ferrule.

The right way to dip it. Never dip more than half the bristle length of a brush into a pot of paint—and a third is even better. Deeper dipping causes paint to build up on the heel, resulting in caking and dripping. Don't wipe off excess paint by dragging your brush edgewise across the rim of the can. Instead, tap the bristles gently against the can's inside face. This is important on two scores. Not only will edgewise wiping slow up the job by making you dip your brush more often; in time it will ruin the best of brushes by causing its bristles to separate into clumps. The original shape of such a brush can never be restored.





Using the correct stroke. Whenever possible, apply paint with long, steady strokes, alternating their direction to make full use of both sides of the brush.

Don't paint with a heavy hand—remember that most of the paint is transferred from the tips of the bristles, so use only enough pressure to curl the end of the brush slightly. Naturally, a fully loaded brush slides most easily. A half-dry brush will drag, and waste time because you must dip it more often.

To insure a uniform finish, always touch the freshly loaded brush to an unpainted area, and work toward the just-completed wet area. End strokes with a gradually lifting motion. Work rapidly until an entire section is completed, to prevent lap marks. To obliterate any strokes that do show up, finish with a series of very light strokes, using an almost dry brush.

To work into corners and other tight spots, start painting a short distance away, and then ease the bristle tips into the difficult area. Don't poke or jab. You'll not only ruin your brush, but get a rough finish in the bargain.

Use a sash brush to paint small, round poles, or other narrow surfaces. Using too large a brush is a common cause of fishtailing—or splitting the bristles into two clumps. Most manufacturers advise—rightly—against using a wide brush edgewise. This, too, if done repeatedly, will split the bristles into clumps.

If you must use a brush edgewise—as when cutting in around trim and other adjoining surfaces of a different color—compensate by immediately brushing back and forth vigorously with both brush sides to smooth out any bristle distortion.

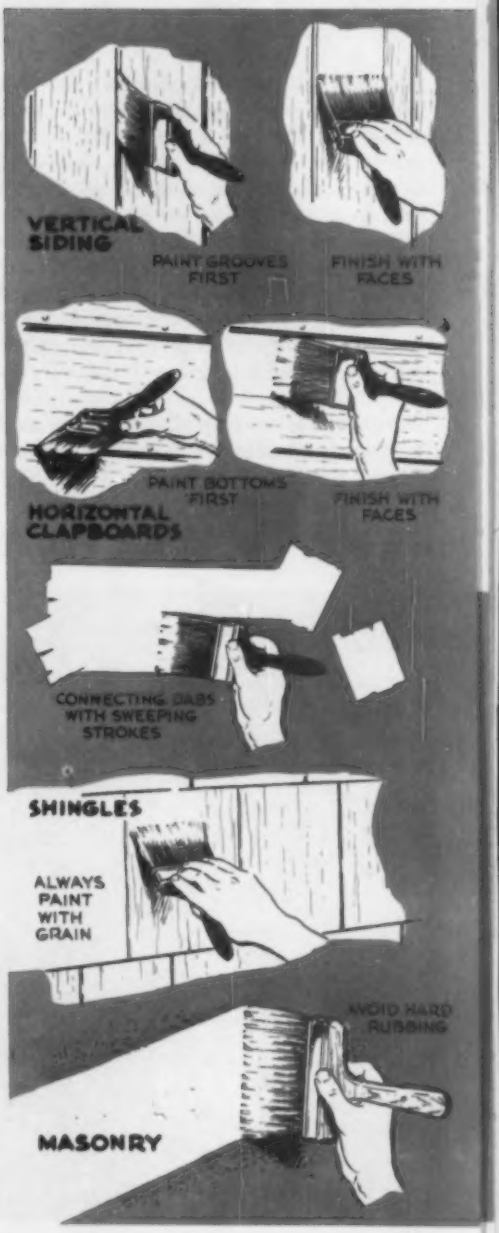
Special-facing Techniques

Clapboard and siding. On vertical siding, first paint the grooves between the boards in the area within reach. Then do the face of each board. On horizontal clapboard siding, paint the bottom of each board first; then double back and paint the face. In either case, use a 3½" or 4" brush, and flow the paint on liberally with a full brush, working with the grain.

When applying a prime coat of paint, rub it well into the wood. Allow this primer coat to dry for at least three or four days of good weather before recoating.

You'll find that house paint made for finishing coats is more fully bodied than primer and does not flow out as easily. To save your arm, many experts recommend that you first smear the paint on in a series of large dabs, then connect and smooth them out by brushing with long, sweeping strokes. Use your whole arm, and follow the grain whenever possible. Finally, obliterate brush marks by stroking gently with the tips of an almost dry brush. Apply clear varnish or any other natural finish in the same manner.

Wood shingles. As with horizontal clapboarding, do all of the bottom edges of shingles first, unless they are double-course, with a visible space between rows. In that case, feather the brush up into this space before doing the edges and faces. Scrub the paint or stain in thoroughly, to fill all porous sections. Because their edges are rough, shingles are harder to cover than siding, and spattering can't be helped. A



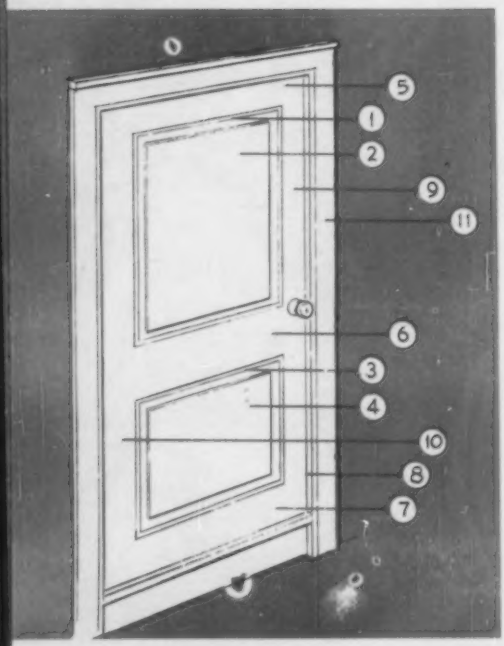
short-bristled brush, or one slightly worn, actually works best.

Asbestos shingles. Getting a good bond is a problem here. For best results, use one of the special primers made for asbestos shingles. Make all brush strokes vertical, or parallel to the striations—brushing across the grooves will cause paint to build up in them, and then run down and drip. Keep a whisk broom handy while painting to remove any last-minute accumulation of dust and dirt. This, too, will insure a better paint bond.

Masonry. If you use powdered-cement paints, they must be mixed with water immediately before use and brushed on while the surface is wet. With a hose, spray an area no larger than you can cover before the water evaporates. Then apply the paint with a scrub-type whitewash brush. Because these paints contain lime, it's best to wear goggles and gloves.

Most ready-mixed masonry paints, whether oil, alkyd or latex, require no wetting of surfaces before application. They have a creamier consistency than the powdered-cement paints and will not spatter quite as much when they are brushed on. You can use a 6″ brush or a deep-nap, long-fibered roller. Avoid hard rubbing—it will spread the paint too thin.

How to paint doors



The right sequence to follow when painting a paneled door is shown in the accompanying drawing. Start with the molded edges of the top panel, or panels (1). Paint the panel (2). Continue working downward until all panels are completed (3, 4). Paint the faces of the horizontal rails, again working from top to bottom (5, 6, 7).

If the door edges are to be painted, do these next (8). On a front door swinging inward, the hinged edges should be painted with the outside color, while the lock side is matched to the inside woodwork. Finish with the stiles (9, 10). If practical, remove hardware to simplify brushing.

Paint the door frame *after* the door. Do only the part that is visible from the outside when the door is closed. Begin with the stop moldings and jamb. Then paint the casing and ornamental trim around the frame.

Window painting

Sash and frames. Raise the bottom sash to the top of its track and lower the top sash at least halfway. Paint horizontal window strips (1), and then vertical strips (2) on the lowered top sash. Next paint the exposed area of the top rail on the raised lower sash (3), and come down a few inches on its vertical strips and side rails (4, 5, 6). Follow by sliding each sash back to nearly closed position. Finish painting all strips on the lower sash (7, 8). Then do the stiles on both (9, 10, 11, 12). Finally, paint the horizontal rails (13, 14, 15).

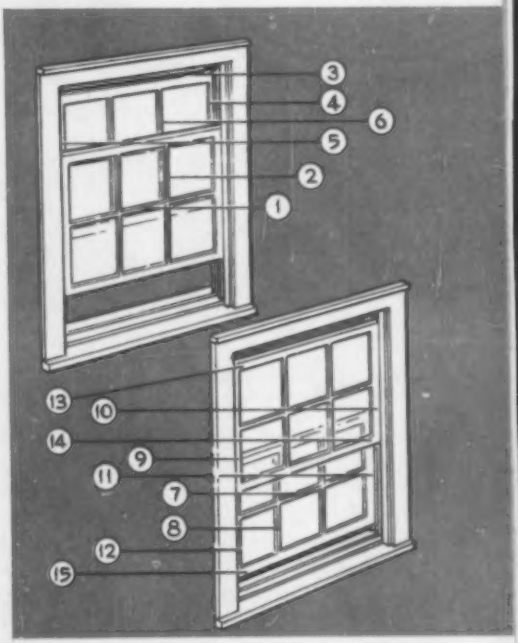
To help keep paint off the glass, use regular masking tape, liquid masking tape, a painting shield—or just a steady hand and a fair amount of patience.

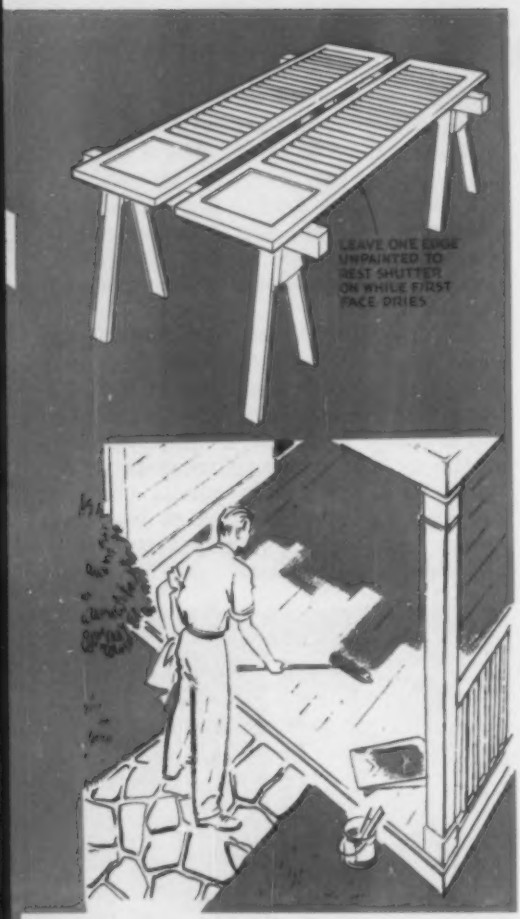
Liquid masking tape is what its name implies. You smear it over the edge of the putty and onto the glass in a band about 1″ wide. It dries to form a rubbery tape. Any that overlaps the putty can be painted over without harm. The day after painting, you score around the edge of the putty with a knife and peel the tape off the glass. Paint smears go with it.

A painting shield is a thin, curved plastic or metal strip that is held against the putty and moved along with the brush to protect the glass.

In the long run, however, you'll save time if you learn to "cut in" your sash as the pros do—using just your sash brush. Touch the tips of the bristles to the putty, allowing part of them to rest on the face of the molding. Press down lightly with a slight twisting motion, to make the bristles in contact with the putty fan out to a sharp edge. Move the brush slowly but evenly, pressing it forward to keep the tips along the molding, at the same time just contacting the glass. For a watertight seal, allow the paint to overlap the glass about 1/16″. Wipe off any smudges on the glass with a rag wrapped around your finger, or let dry and scrape them off later with a razor blade.

Window-frame painting comes after the sash is completed. With the top sash lowered a few inches, paint the head jamb across the top, including the parting strip and all other parts of the outside frame. Next, raise the upper sash until it is almost closed and paint the bottom part of the exposed jamb and all surrounding trim. Do the window sill last.





Shutters and screens. These are best laid on flat sawhorses or other supports. When painting shutters, do one side and three edges, then stand them on the unpainted edge for drying. Paint this edge when you do the other side. If you have louvers to paint, do the exposed edges before the faces.

With screens, paint the wire first, if it needs it. Apply special screen enamel or spar varnish with a carpet-covered applicator. Pour the paint or varnish in a shallow pan, dip the applicator in it, and use a scrubbing motion to coat the wire.

Miscellaneous Trim

Painting facia boards or other exterior trim often requires you to cut in the edges, just as you did on the sash. Use a 2½" or 3" brush, and follow the same technique of touching the bristles to the edge, with part of them overlapping the face of the board.

Railings, trellises, or other ornamental structures should be painted from the top down. Always be on the lookout for sags, runs or drips, and pick them up promptly. Paint hard-to-reach portions first, front parts last.

Porch and patio floors

These get a lot of wear and may need repainting every two or three years. Whether wood or masonry, make sure the surface is absolutely clean and dry. A roller fitted with an extension handle is your best bet. It saves time and practically eliminates the need for bending, except around edges. Just pour a puddle of paint in one corner and start spreading it with the roller. If your floor is in bad condition, don't try to cover it with one heavy coat—two thin ones will stand up much longer. On wooden porch floors that have a crawl space beneath, paint the underside as well as the top.

Gutters and downspouts

Nonferrous metal gutters of some types theoretically don't need painting, but they'll look better and last longer if you give them a protective coating every time the house is painted. If you apply black asphaltum to the inside of either wood or metal gutters you'll save time by using a small mop rather than a paintbrush.

With wooden gutters, paint the outsides while you're doing the trim. Metal gutters can also be given a finish coat of trim paint, but for the first coat you should use a rustproof metal primer. In the case of aluminum gutters and downspouts, make sure that the finish coat is one that contains no lead.

Brush and roller cleaning

The secret of cleaning your brushes easily is to get after them as soon as you stop working. If you have been using latex-, alkyd- or cement-based paints, give them a good washing with soap and water. For brushes loaded with other types of paint, start by wiping off as much excess as you can. If you plan to use these brushes next day, follow the wiping with a rinse in turpentine or the proper thinner. Then leave them suspended in clean solvent.

If brushes used with oil paints are to be stored for any time, they'll need more thorough cleaning. After working out the paint, wash them in several rinses of thinner, or one of the many good liquid brush cleaners now available. If you use one of these, start by rubbing the bristles against the bottom of the can to work the cleaner up into the heel of the brush. Then grasp the bristles in your fingers and work them vigorously in the liquid. At the end of a minute or two, spread the bristles and check to make sure no paint is trapped near the ferrule. When a brush is clean, squeeze out the liquid, smooth the bristles, and wrap in paper or aluminum foil.

To clean paint rollers, run them over newspaper to remove as much paint as possible. Then slide the cover off and wash it in the proper thinner. Replace the cover, wrap the roller in sheet plastic or aluminum foil, and store it either suspended by the handle, or upright. If you let a roller lie on its side for any length of time it will develop a flat spot.

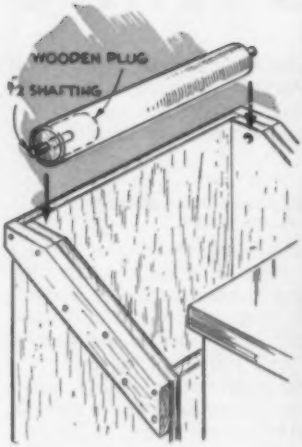
P. S. EXTRA: YOUR TEAR-OUT BOOKLET NO. 8

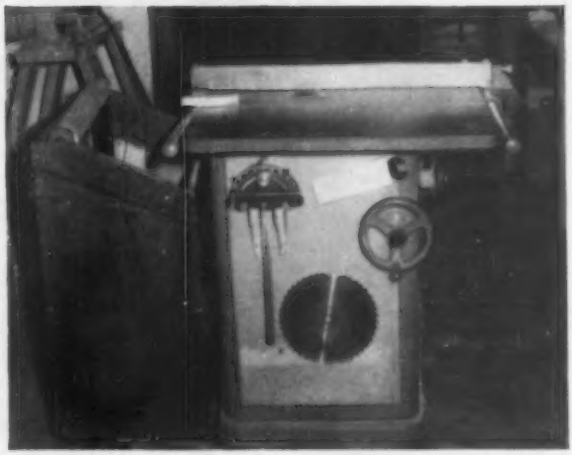
To remove this booklet, place your left hand on the facing magazine page, grasp the booklet with your right, and pull it gently away.

After reading, file for future reference. You'll find it valuable on many home jobs.

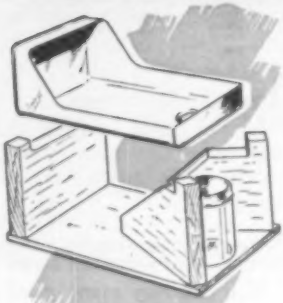
April 1958
POPULAR SCIENCE

The POPULAR SCIENCE Shop Notebook

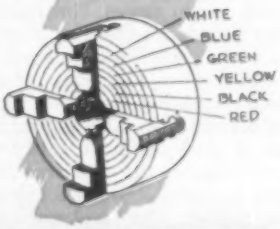




You'll get double service from this table-saw accessory—a scrap bin that catches small pieces of cut-off, and provides a support for ripping long boards. For best results, the top of the roller should be ¼″ below that of the saw table. This way it will support long boards when the bin is moved back from the saw, but short stock will override it when the bin is in its scrap-catching position right up close to the back of the table. *—Robert S. Tupper, Canton, S. D.*



Small-parts sorter made from a one-gallon can and scrap wood speeds up the chore of getting nails, screws, washers and the like into the right containers. Fold over the sharp edges after cutting the can to shape, and use a ball-peen hammer to depress the edges of the hole cut in its bottom. Make the base uprights high enough to accommodate whatever size jars or other containers you use.



To help you center work quickly in an independent lathe chuck, paint concentric rings of different colors on the chuck face. It takes but a moment to move the jaws into the color ring nearest the desired setting. Then make your final, precise adjustment with the help of an indicator, or with a piece of chalk.*—Fred F. Wegener, Indianapolis, Ind.*

Emery board used for manicuring makes a good jigsaw sanding stick when you trim it to length and dress the ends to fit the blade chucks. To sand heavy work, it's a good idea to back up the board with a strip of sheet metal that you have cut to the same size. *—R. J. De Cristoforo, Los Altos Hills, Calif.*

5 Rules for Keeping Whitewalls White

By Walter E. Burton

ANYONE who owns whitewalls knows that they have to be kept that way. If the problem irks you, shouldn't you have bought black tires in the first place? But take heart:

Caring for whitewalls is slightly less troublesome on today's cars. When 14-inch tires were introduced, the makers reduced the width of the white band. This, they say, makes the smaller tires *look* even smaller. It also gives the owner less white area to keep clean.

Some time ago it occurred to me there might be tricks to the whitewall-cleaning job. So I set out to see the men who should know—engineers for the major tire makers. Here's what they told me:

1 CLEAN THEM OFTEN

Said one veteran tire technician: "Keep dirt from becoming deeply embedded, and in the long run you'll save both time and work."

2 LOOK IN THE KITCHEN FOR THE CLEANING MATERIALS YOU NEED

You can buy many good preparations for the cleaning job from car dealers and auto-supply stores. But chances are, you can also do an effective cleaning job with just what you'll find in your own kitchen.

Steel wool and soap or soap-impregnated scouring pads were recommended by several men. Dirt embedded by scraping a curb is most easily removed by scrubbing in the direction of the scrape; that is, parallel to the scratches or cuts in the rubber. The steel wool tends to tear apart when it is rubbed over raised lettering, and you may need several pads to do all the tires, but rinsing carries off the shreds of steel with the suds.

Powdered household cleansers also do a good job. Apply with a wet cloth or brush, scour as necessary, and then rinse. Abrasives such as powdered pumice have sometimes been used to remove really stubborn spots. There is little chance that such abrasives will damage a tire, the tire men explained, since rubber tire compounds are made especially to withstand abrasion.

3 REMOVE THE CLEANER AS SOON AS IT HAS DONE ITS WORK

This rule could prevent damage if the cleaner is a type that might soften or otherwise affect rubber during prolonged contact. One technician cautioned that a strong alkali could soften the rubber and make it very difficult to clean.

Gasoline, household dry-cleaning fluids, and any other cleaner that has a solvent action on rubber should be used cautiously if at all. Prolonged contact should be avoided. Tire men expressed the view, however, that a cloth moistened with high-test gasoline or household cleaning fluid could safely be used to wipe off a spot of grease. This small amount of solvent would evaporate before it could do harm.

4 HOSE THE TIRE THOROUGHLY AFTER USING A CLEANER

Don't slight the rinsing step when you have used a water-soluble cleaner. Use a hose with good pressure. Be especially careful to wash out all cleaner and dirt from the recess formed where tire and rim meet. Otherwise, ugly streaks of dirt may mar the white band as soon as the wheel begins to turn.

5 REMOVE OIL, GREASE AND ROAD TAR AS PROMPTLY AS POSSIBLE

Not only do these spoil the looks of the tires, but they may damage or stain the rubber.

Scrape or wipe off all you can, apply a commercial or household cleaner in the recommended way, rinse, and dry. If a stain remains on the tire, there are two schools of thought among tire men about how you should proceed.

One group recommends wiping the stain with a cloth moistened in high-test gasoline or household cleaning fluid. Al-

low plenty of time for the solvent to evaporate, then use an abrasive cleaner again. If some stain still is in evidence, leave it alone for a few days. Elements that penetrated the rubber may then bleed out.

Another group looks with disfavor on the use of any rubber solvent. Instead, they suggest spreading pure lard or oleomargarine over the stain and leaving it until the staining materials have been softened. The dissolved sludge should then be wiped off, the area scrubbed with a grease-dissolving household cleanser and finally rinsed thoroughly with clean water.

Should you be tempted to try one of the commercial preparations now sold for de-tarring fenders, the best advice is—don't, unless you've first read the label and found that the preparation is specifically recommended for use on rubber. Technicians here are in agreement: A mineral oil or lubricating grease should never be used to soften tar on a tire.

But what if nothing works? What should you do if, despite everything, your tires have become hopelessly dirty or discolored—tires that started life as whitewalls but clearly aren't any more.

Then you have two final alternatives. You can clean the tires the best you can, and paint over the remaining dirt with one of the white rubber paints sold in auto-supply stores.

Or you can probably turn the whitewalls around so they'll be blackwalls. Makers foresaw the fix you might be in: The majority of today's whitewalls are reversible for just that reason.

"You need special spark plugs, too"

Always use the spark plugs specially designed for outboards—

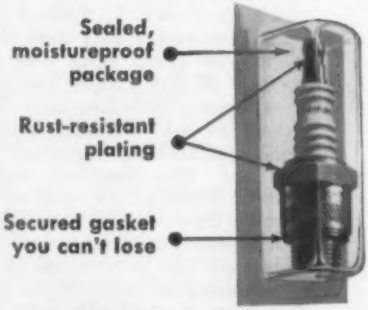
CHAMPIONS!

You need a *special* trailer for boats. And you need special spark plugs for your outboard—Champions.

New Champion marine spark plugs are protected by a sealed, moistureproof pack. The gasket is secured so it can't be lost. And the exposed metal surfaces of this new Champion are guarded by rust-resistant plating.

This new marine plug has Champion's special "J-gap" electrode design . . . needed for easy starts . . . smooth idle . . . and full power in outboard engines. This "J-gap" is one reason why *every major outboard manufacturer uses Champions as original equipment.*

Choose either the *new* marine Champions or the *regular* marine Champions. But always choose CHAMPIONS—the spark plugs specially designed for outboard motors.



CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

Every major outboard manufacturer approves — and uses CHAMPION Spark Plugs

Happy day!

Your First Day in a New Car

It's a bright moment when you accept the keys of a new car. Behind you are the bargaining, the paper work, ahead a sequence of payments. Right now, a happy chore: learning the etiquette of living *with your car. You're eager to get the feel, master any of the gimmicks—you expected some—then take your wife for the first ride. It's a moment to savor. Let's say the moment is now; the car above, yours. Agreed? Then turn the page and take the wheel . . .*

PHOTOS BY W. W. MORRIS

Use the owner's manual—it aims to put you in command. And try dash controls now so you'll know where they are without a fumble when there's company aboard

Park her just c'ose enough, slowly, without bumping the tires. Then sight over the hood ornament at the curb. Now you'll always park right

How does she back into parking space? Line up the hood ornament of the car behind you in the mirror

Check the clearances during your first

First Day in a New Car

Let your wife in on the fun. If you don't tell her, how's she going to know those red lights on the dash are supposed to go out when the engine starts?

ride. Pull up by a parked car. Then get out and see—were you too close or a mile wide?

Explore under the hood, the owner's manual your guidebook. Get familiar with whereabouts of crankcase and auto-transmission dipsticks and the power-steering reservoir. While you're at it, be really professional—check their levels

Be sure you have what you've bought: Check off equipment on car invoice. The extras all there? Spare tire, jack?

Looks acrobatic maybe, but peer up under the dash for two reasons: Get a look at the fuse panel, record radio's serial number

A last idea, that first day: Put wood chocks on the garage floor as guides for getting all your new car in. Now you've earned it: Happy highwaying!

Gus Treats a Case

When the pretty schoolmarm's car wouldn't back up, Stan was sure he could fix it. It was lucky he had Gus to back him up

By Martin Bunn

GUS WILSON slammed down the phone in the Model Garage. Why, that old coot Silas Barnstable, asking him to pull his old clunker out of the mud, then having the nerve to add: "And don't send that young whipper-snapper Stan Hicks!" Stan had turned into a darn good mechanic, even if it did seem like only yesterday that he was hardly old enough to shave.

Gus sighed at the passage of time and headed for the tow truck.

"Watch the store, Stan," he called back. "Have to give old Silas a tow."

A heavy overnight rain had left huge puddles everywhere this morning. Spring was in the air. . .

A horn blared in the doorway. Stan got up from his work abruptly and whacked his head on a car hood. Stunned, he motioned frantically to the driver of the 1957 Ford lunging down the center of the shop, and stepped aside just as the car dipped to a stop.

"Hey, lady! What are you trying to do, kill me? Drive it into a stall!"

A pretty young face framed with glistening black hair popped out the window. "No sir! I'm parking so I can drive out the back door if necessary!"

Before Stan could utter another word, the young lady stepped out of the car. We-e-ll, thought Stan, I'm glad Gus didn't send me to rescue Barnstable.

"Where's Mr. Wilson?"

"He's out on a call. I'm Stan Hicks, his assistant."

"Oh. . . I'm Mary Atkins. I teach kindergarten at the elementary school."

"You're a schoolteacher?" Stan blurted. "Why, you don't look old enough to—"

Her impudent little nose lifted. "Mr. Hicks," she snapped, her eyes flashing, "I came here to get my car repaired. I *can* go elsewhere!"

Stan smiled sheepishly. "Don't get riled up, Miss. I'm sorry. It's just that—well—doesn't seem like we had teachers like you when I was in school."

The fire left her eyes and she gave Stan a quick smile. "I'm sorry, too. And I'm sorry I made you bump your head. I was mad. You see, I just had a spring tune-up last week. Now the car won't go in reverse and the radio makes a funny noise. I tried to parallel-park in front of the department store

# of Spring Fever

"Stan's out for a few minutes, Miss Atkins," Gus said. "But he did mention a minor adjustment he forgot to make on your car."

downtown and the car wouldn't back up!"

Eager to prove to his pretty customer that Gus Wilson was not the only mechanic in the Model Garage, Stan quickly lifted the hood and examined the gearshift linkage. It seemed okay. Then he recalled the tune-up she had mentioned. If the emergency-brake cable had been adjusted too tightly, the car might move ahead freely, yet hesitate to back up because rear-wheel brake shoes have a tendency to self-energize if maladjusted.

Sliding a jack under the axle, Stan slid under, checked the emergency-cable tension and then slowly rotated the rear wheels. "The wheels turn backward."

"Well, perhaps the wheels move, but the gearshift lever won't go into reverse!"

Stan slipped into the seat and tried the shift lever. With the clutch depressed, it slipped into reverse easily.

"But it wouldn't work for me!" the girl insisted.

Stan reached for the ignition switch. "Let's drive it back and forth and see." As he turned the switch, a loud "clack" came from the vicinity of the radio.

A shapely arm flashed past Stan's nose and an accusing finger pointed at the radio. "There, that's what I meant was wrong with the radio!"

"It doesn't sound like the radio, Mary —er—Miss Atkins."

TURNING the switch off and on, he added, "Sounds like a relay to me." Glancing across the dash, his eyes spotted the overdrive-lockout control. "Sure." He grinned. "The overdrive relay. It's mounted in the engine compartment right in front of the radio. It could sound like the radio to anybody who didn't know."

"But what about the reverse?"

"You have a ground between the relay and the overdrive governor switch," Stan announced, reaching for a creeper. "That's why your car won't back up."

He slid beneath the car and checked the wire leading to the tiny governor projecting from the overdrive housing. The wire looked sound. Remembering Gus's counsel about faulty switches, he removed the wire and rubber boot covering the switch.

From above trim ankles came a plaintive voice: "But what have this 'ground' and 'governor' got to do with the reverse gear?"

"Just wait—I'm going to tell you."

Stan slid out, governor switch in hand. "This little gadget should be the troublemaker," he said, inverting the switch and clamping it in the vise. Removing the screws from the cap, he explained that the unit is a centrifugal switch.

"See, here's the trouble." Stan pointed to a tiny drop of dirty water on the switch points inside the cap. "You had continuity across the points all the time because of this drop of condensation." He wiped the cap dry, polished the points, and replaced the cap.

"Is that all that's wrong?" she asked.

"Probably. You see, the condensation made the relay energize every time the ignition switch was turned. Then *that* energized the overdrive solenoid. The solenoid kept the lockout rail from letting the low-reverse sliding gear engage with the reverse idler. Understand?"

"Good heavens, no!"

Stan chuckled. "Okay—let's try this. With overdrive, when you reach about 28 miles an hour, centrifugal force shoves the flyweight segments in the governor switch-out to close the switch points. When the governor switch closes, the car can go into overdrive. At the same time, the transmission is locked in such a way that you can't shift into reverse when in overdrive. Your switch was closed all the time, so you couldn't possibly shift to reverse. That better?"

"A little," she answered uncertainly. "My, you certainly know a lot about cars."

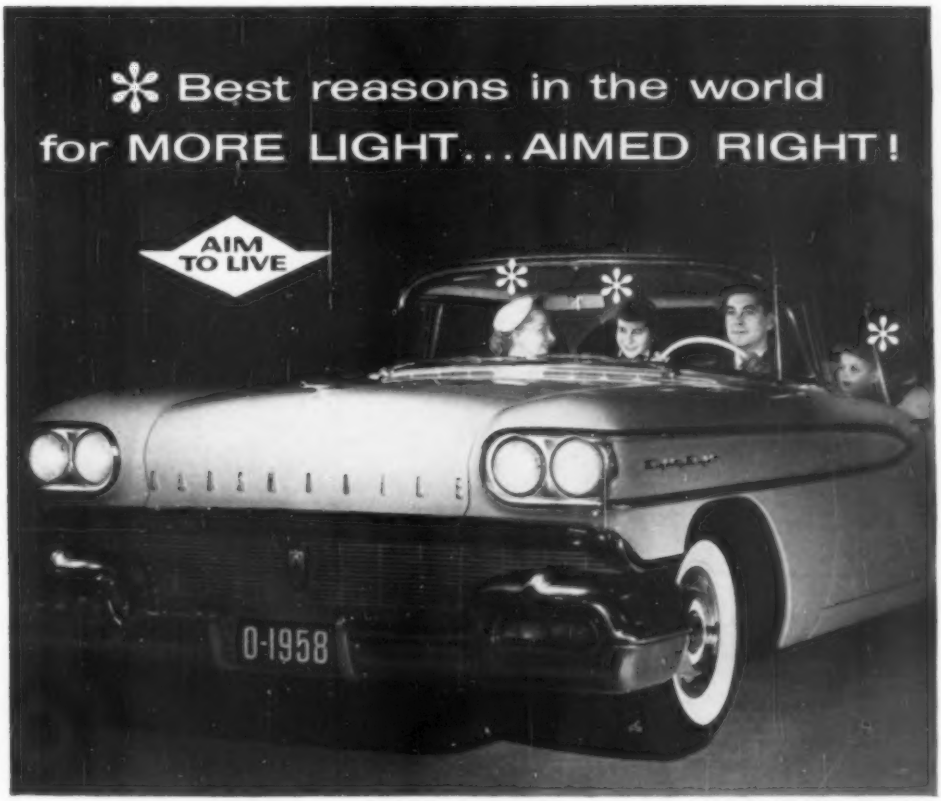
It was a while before Miss Atkins left the shop. In fact, she'd barely departed when Gus Wilson returned.

"That old tightwad," Gus said as he stepped from the tow truck. "Bald tires, no chains. Any business while I was away?" He lit his pipe and walked over to the shop order pad.

"Not much," Stan replied from under the hood of a car. "Just an old schoolmarm, a Miss Atkins or something. Car wouldn't back up. Overdrive. Took off the governor switch, put it in the vise, found a bead of condensation across the switch points. I cleaned the points and put it back on."

After a long thoughtful silence, Gus said, "I'll bet Miss Atkins comes back inside half an hour."

"You're pulling my leg, Gus. Bottle of



"AIM TO LIVE" has an especially deep significance to the family man. He seeks every protection for himself and them. And one of the simplest for him to provide is the extra margin of night driving safety available through new Guide T-3 Headlamps.

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soda says she won't come back. Okay?"

"That's a bet, Stan. Thirty minutes."

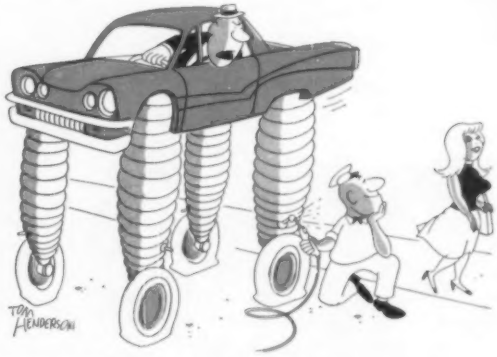
"Right," Stan agreed. "Say, Gus, I've got an errand at the drug store. Okay if I take off for a few minutes?"

GUS, bent intently over a running engine, didn't hear the Ford come in, or see a pretty, dark-haired girl get out.

"Stan! Stan!"

Gus turned.

"Oh," she said breathlessly, "You're Mr. Wilson."



"I said fill the tires, not the air suspension!"

"And you're Mary Atkins."

"Stan—uh—Mr. Hicks repaired my car. Now it won't back up—*again!*"

"I see," Gus said. His eyes twinkled. "Stan's out for a few minutes, Miss Atkins. But he did mention a minor adjustment he forgot to make on your car."

REACHING for the air hose, he slid under the car, then reappeared. He smiled. "There—everything is fine now."

Miss Atkins was just driving off when Stan came sauntering across the street. Spotting the familiar car, he broke step and dashed toward Gus.

"Guess the sodas are on you, Stan," Gus announced.

"Was she in here?" Stan demanded.

"Yep, and I fixed her car."

"Okay." Stan groaned. He walked to the vending machine and came back with two bottles. "Tell me what I did wrong."

"Well," Gus began, sipping his free drink, "when you're at the ball game with her tomorrow you can tell her—"

"Ball game with her? How'd you—"

"Well, first off, I knew she wasn't an 'old schoolmarm.' Remember, I'm on the school board. In the second place, Stan, you don't usually write down the phone number, the landlady's name, and the color of the customer's hair and eyes on the shop order. Or circle the phrase 'two o'clock, Randall Field,'—which, in case you didn't know, is the time and place of the opening game for the high-school baseball team tomorrow. And lastly, if that package you brought from the drug store isn't candy, I'll eat it."

Stan smiled weakly. "Gus, you've got me. How'd I lose the bet?"

"You mentioned condensation. That was the tipoff. The switches hardly ever collect condensation, but once in awhile they get water inside when driven through hubcap-high water. Like today—

"On this model Ford, the governor switch points almost downward. You said you put it in the vise to take the cap off—upward, I figured—and just cleaned the points. So I guessed, since you couldn't see inside the governor because of the circular flyweights on this model, that there might be more water inside.

"Now a slight knowledge of the workings of the female mind told me Miss Atkins would return to the store, because today is Bargain Day. Any bump on the way might shake down the water, shorting the switch again.

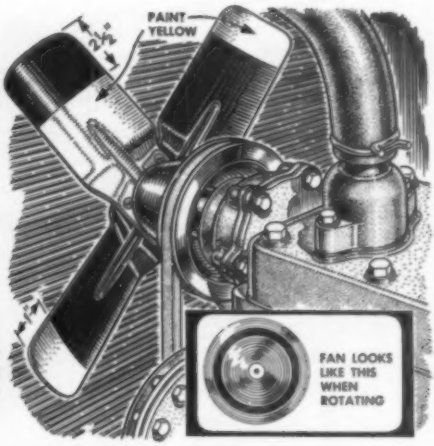
"You tell her tomorrow, when you buy *her* a soda at the game, that the way to get liquid out of a container is to tip it upside down. Which is just what I did. I blew the water out of the governor, right on the car."

Gus chuckled, then added, "Here's a couple of tickets for the game. Red Plummer gave them to me."

Stan handed one ticket back: "Thanks, Gus, but you go, too. I'm doing a *little* thinking today—teachers go free." END

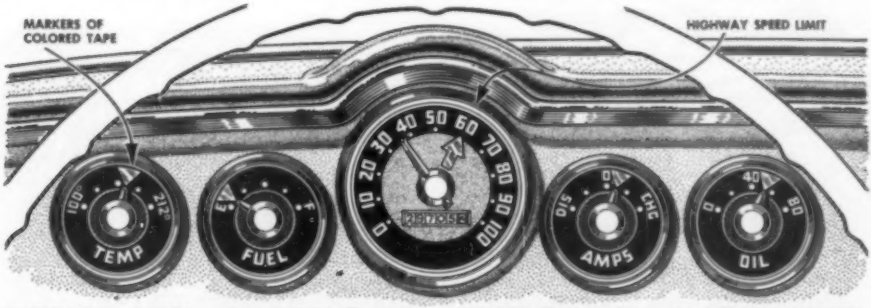
Next Month: Gus meets a master fixer.

Hints from the Model Garage



Make a trouble lamp that *really* illuminates the work area. Use an old two-beam headlight in which one filament has burned out. Solder wires about 12 feet long to the good terminals of the bulb and attach battery clips to the wire ends.

A rotating fan will show up clearly as a yellow disk with a black ring when *part* of each blade is painted yellow for safety, as shown above. To avoid splashing, use a fast-drying paint and let it dry thoroughly before starting the engine.



TEMPERATURE GAUGE. Place marker on glass in line with needle after stabilizing engine's temperature by driving the car for at least half an hour.

FUEL GAUGE. Run engine until fuel in tank is exhausted. Then pour in three gallons and mark position of needle so you'll know your gallon reserve.

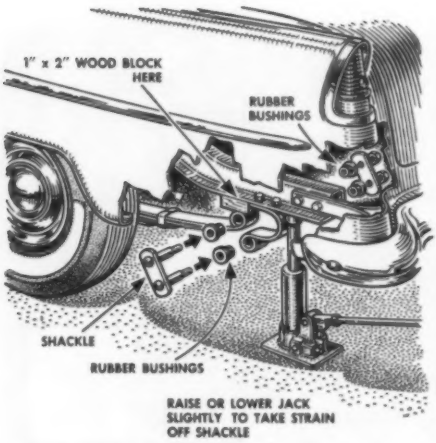
AMMETER. Run engine until needle drops down to normal charging rate. Then, with lights and all accessories off, mark its position at fast idle.

OIL-PRESSURE GAUGE. Mark needle's position while running engine at speed equal to about 30 m.p.h. Be sure that the engine is thoroughly warm.

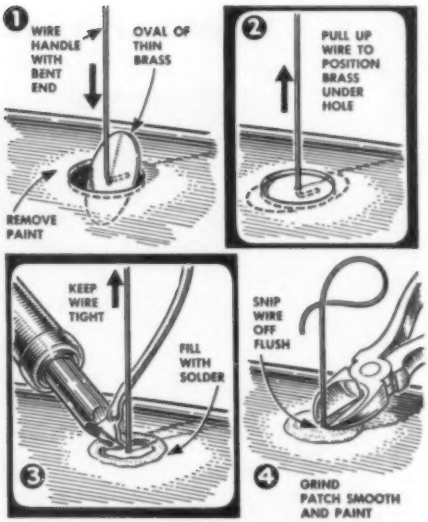
You can keep tabs on your car's performance and note gradual deterioration by marking the critical readings on the dash instruments with small arrow heads cut from colored gummed tape. The arrows will also serve as an operating guide to other persons driving your car. Place an arrow opposite the speed limit for your state to keep you from unconsciously exceeding it, and stick one on the fuel gauge to indicate the actual amount of gas remaining as the needle nears "E."

Please turn the page for more hints

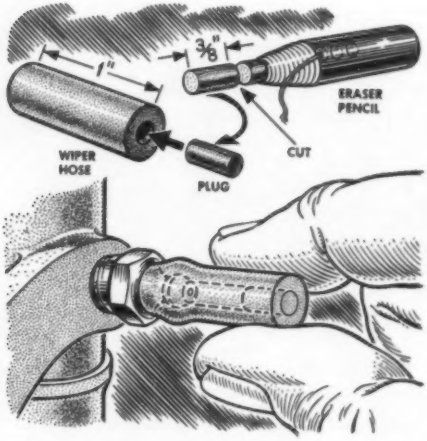
More Hints from the Model Garage



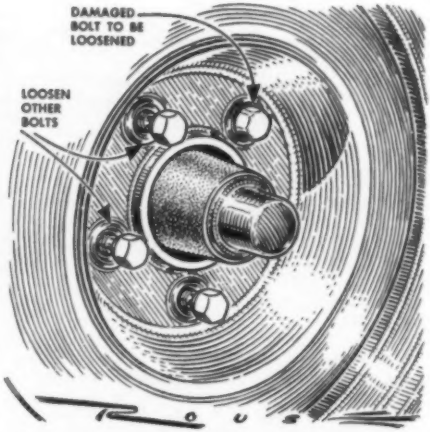
Worn spring bushings can be replaced without effort. Jack up the chassis until there is room for a block of wood between the spring and hanger eyes. Then lower the chassis. With tension off the spring, the shackle can be removed easily.



To fill a screw hole after removing an accessory, back it up with an oval of brass held in place with a wire. Flow solder over it to build up the surface and snip off the wire when the solder sets. Grind the patch flush and paint to match.



Protective caps, quickly made from windshield-wiper hose, will keep grease fittings clean and make them easy to find. Cut the hose into 1" pieces and close one end with plugs cut from an eraser stick. Clean the fittings *before* you cap them.



When a wrench won't grip the head of a damaged wheel lug, you can sometimes jar it loose. With the car jacked up, loosen the other lugs. Then lower the car and rock it back and forth to make the wheel shift slightly, causing the lug to turn.

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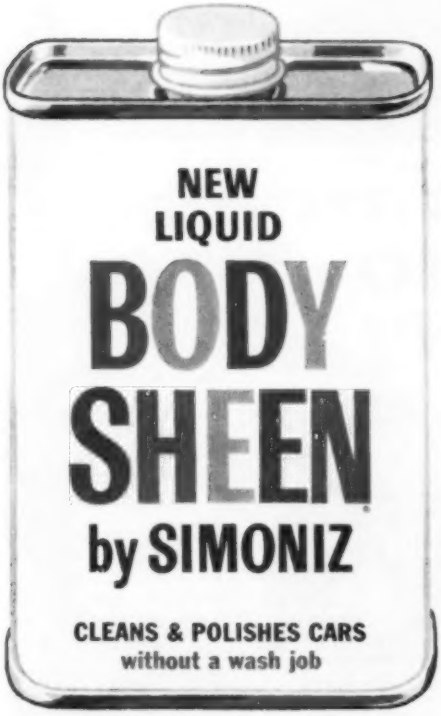

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BEFORE AND AFTER: Hi-fi pours from set at right, although it doesn't look much different from its old self (above). Only changes that show in front: a grille-cloth-covered port for speaker enclosure, at lower left, and new pre-amp, sitting on upper shelf.

Hi-Fi and Electronics

I Built Hi-Fi into My Old Phonograph

By Everett H. Ortner

WITH simple carpentry, a few tools, some good advice, and plenty of trial and error, I'm getting music now from my old phonograph that its makers never built into it.

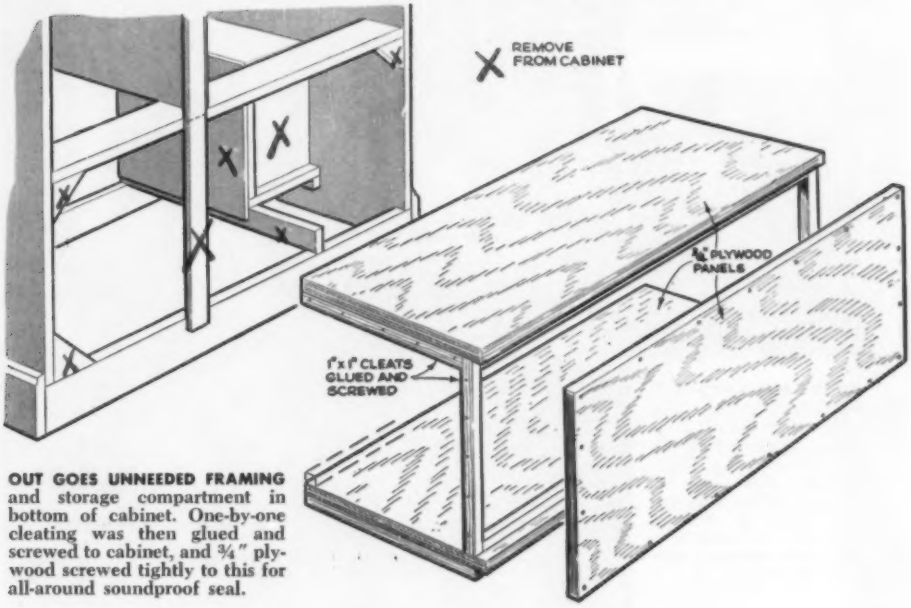
My radio-phonograph, five years ago, was the Cadillac of its day. It set me back 400 simoleons, and tone wasn't the primary reason we chose it. We got it because my wife liked the French Provincial cabinet. The set was sweet-toned and pleasant, but you knew you were listening to a record player. Carnegie Hall never moved into my living room—a fact that became increasingly apparent as each of my friends got real, certified hi-fi sets (and Carnegie Hall) in *their* living rooms. They discussed decibels and cycles, while I, a hi-fi have-not, listened sadly.

I started my campaign of improvement by getting a friend—a hi-fi expert—to help me plan a two-part program. The first phase required little money but plenty of non-expert elbow grease: (1) replace all tubes, (2) enclose speaker compartment, (3) install a better pickup, (4) level the record changer, (5) experiment with set location.

The second phase required scraping up the cash for: a turntable and tone arm, magnetic pickup with pre-amp, tweeter and crossover network.

Tube replacement worked unexpected

Bass-reflex enclosure needs only elementary carpentry



OUT GOES UNNEEDED FRAMING and storage compartment in bottom of cabinet. One-by-one cleating was then glued and screwed to cabinet, and ¾" plywood screwed tightly to this for all-around soundproof seal.

wonders. I hadn't realized how much sparkle had disappeared from the old set with tube aging. Now a tinkly clarity came back—along with a pleasant bonus: An irritating on-off buzz that I had vaguely blamed on our kitchen fluorescent lamps disappeared.

Enclosing my speakers was the second step and, encouraged, I plunged into it.

Like most sets made before hi-fi swept the nation, my speaker compartment was open—top, back and bottom. This arrangement helps the manufacturer's profit statement, but not the sound. With the same speakers in a bass-reflex enclosure, my hi-fi expert told me, I could get a better low bass, while ridding the middle bass of its hollow boom.

This took work and—for this uncertain craftsman—courage. I started by sawing out anything inside my cabinet that I could do without. I wanted the biggest cavern I could get.

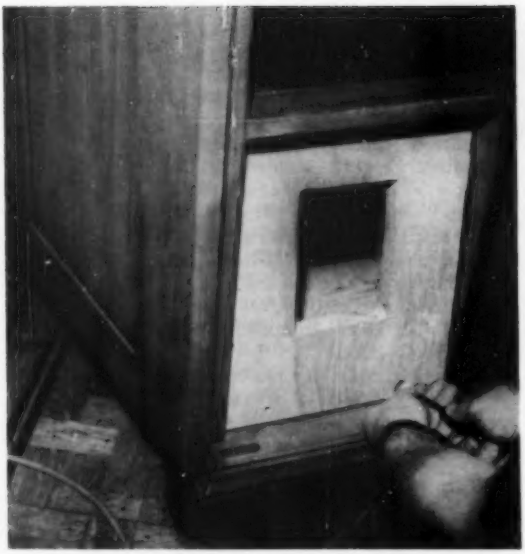
To insure that the ¾" plywood panels—floor, top and back—made solid, airtight contact all around, I cleated them in with one-by-one stock, using plenty of screws.

In front, where my speakers were set in a hardboard panel, futile to screw into, I contented myself with gluing the hardboard side of the cleat.

The critical part of a bass-reflex enclosure is the port. This is nothing more than a hole, of area determined by the volume of your enclosure.

I used the chart accompanying this article to figure the area of my port. This is a rough—but good—estimation. For finer tuning of your port, you'll need a way of changing its size. This can be done either by fitting it with a sliding door so that you can open it or close it down at will, or by making it smaller than the chart shows and then drilling holes around it to enlarge the area. A couple of friends who are out of work are handy here—they sit around and listen to a test signal, such as that provided by Popular Science Test Record No. 1 (PS, Jan. and March '57), while you increase or decrease the port size. Don't despair if you drill too many holes; wood putty will plug them up.

Finishing the enclosure is simple. Ozite—that's the feltlike stuff carpeting is laid on—is stapled or tacked in loose folds around the inside of the compart-



BASS-REFLEX PORT AREA

CABINET VOLUME (CU. FT.)	PORT AREA (SQ. IN.) 8" SPEAKER	10" SPEAKER	12" SPEAKER	15" SPEAKER
2	16	12	8	—
3	32	24	16	—
4	60	45	32	—
5	90	65	50	25
6	—	90	70	36

ESTIMATED AREA OF PORT for enclosure was computed by means of chart at right. Extra speakers do not affect estimate. Simplest way to tune port: Cut it slightly smaller than estimated size, then enlarge by drilling holes, checking sound with a record. Grille cloth, to cover port, can be wrapped around the panel and tacked in back, or glued or tacked in front.

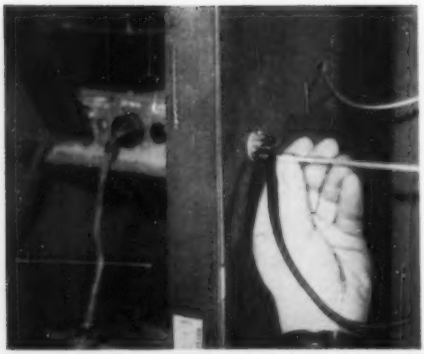
ment; and grille cloth is stretched over the port.

A new cartridge was next on my list, but here I ran into a snag. I discovered that my record changer is one of the few with a non-standard mounting for the pickup cartridge. Unless I bought a completely new record changer, I was stuck with my old pickup.

At this point a brief session with my wife, hi-fi consultant and checkbook produced an alternate scheme. I gave up my dream plan for a semi-professional turntable and tone arm and settled for the present pleasure of a new top-quality changer with a magnetic pickup.

A word here about pickup cartridges, gleaned from talks with my hi-fi friend: Modern ceramic and crystal pickups, he told me, will give a wonderful boost to

INSTALLING NEW CHANGER: After old changer has been lifted out of drawer frame, new changer is set in and new positions marked for metal angle brackets, which hold support springs. Frame was trimmed wherever changer touched. Band permits changer to be lifted without damage during fitting and leveling—latter done by inserting extra washers over springs.



CONNECTION TO PRE-AMP is made through jack, shown being attached. Cord from changer plugs in here. Other wire goes from pre-amp to amplifier. Now, pulling two plugs frees pre-amp.

tone quality even in old sets. They replace the old cartridge and require no alterations or additions.

But if you've got extra money jingling in your pocket and an unwillingness to settle for anything short of real hi-fi, you have another choice: a magnetic pickup. The only drawback here is that you need a pre-amp with it. The magnetic cartridge is beautifully sensitive—but weak. A pre-amp is necessary to amplify the signal before it gets to the amplifier.

One-tube pre-amps, which work off house current, are available, but they have a serious fault: hum and noise. On advice of counsel I ducked the problems usually associated with pre-amps by using the transistor job described at the end of this article. It is specifically designed to match the new General Electric VRII cartridge I had chosen.

Installation of a record changer involves a host of little problems. All I can tell you, to cheer you up, is that none of them are technical and that all can be solved by measuring, cutting and fitting.

Three points should be kept in mind: (1) the turntable must be level in the playing position, (2) the changer must float freely on the mounting springs, (3) the mechanism underneath the changer deck must clear all obstructions.

First I had to relocate the drawer brackets on which the mounting springs rest to match the position on the new changer. Now with the new changer sitting on springs in the drawer, I marked those places where the changer touched inside. I notched and cut away these portions of the drawer until the changer floated freely.

I found it was a good idea to study the effect that the controls had on the changer. A little arm, for example, poked out and snubbed the drawer side when I set my changer speed at 78 r.p.m. I had to cut a slot for sliding room.

Fitting and leveling my changer were made easier for me because the manufacturer, Collaro, had thoughtfully provided a harness so I could lift it with one hand. The leveling, a finicky business, was done by inserting rubber washers between the springs and deck.

Electrical connections were easy. I saved the connecting wires from my old changer because they had plugs that fit the sockets on my amplifier. The shielded wire that had connected the old pickup to the amplifier now goes from the pre-amp to the same socket it used to. The shielded lead on the new changer plugs into the standard socket on the pre-amp. The AC wires that powered the old motor now feed the new one.

With the alterations in the set completed, I enlisted the aid of a muscular friend for the final problem.

Experimenting with location in the room, I used the PS Test Record No.2, "True Sounds of Musical Tones," to give me a broad selection of musical sounds. We tried a half-dozen different spots. The best one turned out to be catty-cornered at one end of the room. Here the growl of the double-bass viol and the chesty tones of the tuba were a delight.

Unfortunately, this location didn't last long. My wife, with that unreasoning conservatism that women often have, objected. We compromised with the set in second-best position—flat against the narrow wall.

But she is delighted with the new sound in our living room, and I think there is going to be a peace offering. I overheard snatches of telephone conversation the other day that included words like "crossover" and "tweeter." My birthday isn't far off. **END**

NEXT MONTH: Baffled by hi-fi jargon? In May PS, a dictionary of hi-fi terms will take the mystery out of these new words.

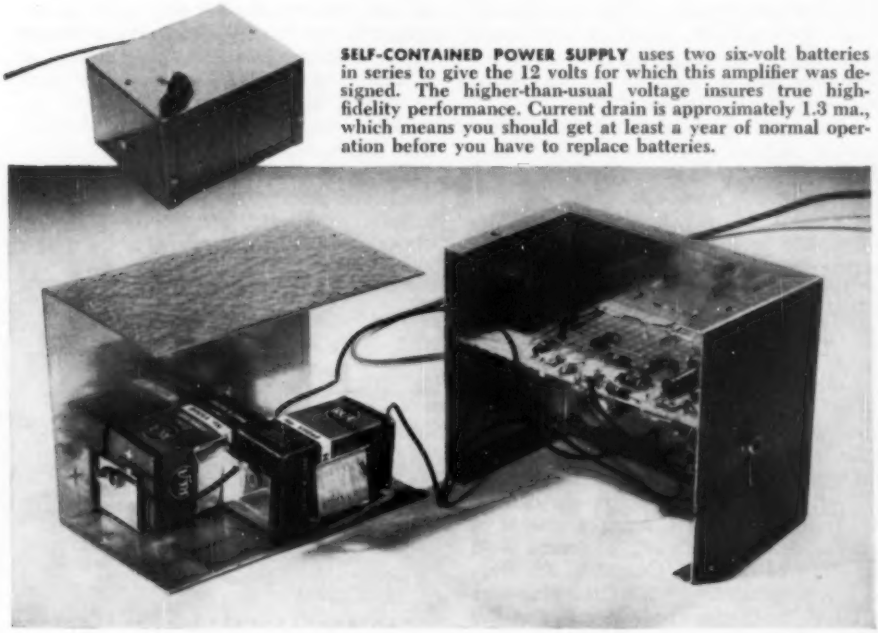
Transistor Pre-Amp Works Without Hum

THIS simple transistor pre-amp gives top-quality performance with a low-output magnetic pickup. Its power requirements are so low that it can operate for at least a year on its built-in batteries. Since no AC power is used, it is hum-free. Transistors are inherently free of other noises, such as microphonics, that plague tube-type pre-amps. So now you can avoid all the usual problems of adding a high-quality pickup to your hi-fi system.

The unit is specifically designed to work with the new General Electric VRII pickup cartridge. It will work equally well with other cartridges if you follow the manufacturer's recommendation for the value of the pickup-load resistor, R1. Record equalization follows the RIAA curve used on practically all modern long-playing records.

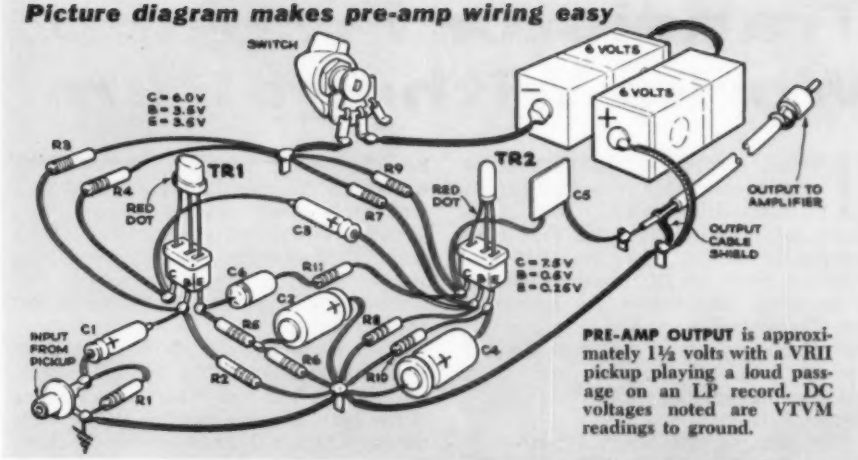
Construction is easy, even for a beginner. Almost any layout of parts will do, as long as you avoid bringing the output and input circuits too close to each other. It can be built much smaller than the one shown in the photograph, but since there is no reason for a tiny unit in most applications, ample room on the chassis makes the job simpler.

Use a perforated chassis board (such as Lafayette catalogue No. MS305) about 2¾" by 4¾". A convenient arrangement of the parts is a straight-line layout with the input terminals at one end of the chassis and the output terminals at the other. First, mount the transistor sockets by cutting close-fitting rectangular holes in the board. Insert the socket and hold it in place with the retaining clip from the opposite side of the board. For identification, note that C terminal stands alone and B and E are close together. The resistors and condensers are mounted by



SELF-CONTAINED POWER SUPPLY uses two six-volt batteries in series to give the 12 volts for which this amplifier was designed. The higher-than-usual voltage insures true high-fidelity performance. Current drain is approximately 1.3 ma., which means you should get at least a year of normal operation before you have to replace batteries.

Picture diagram makes pre-amp wiring easy



PRE-AMP OUTPUT is approximately 1½ volts with a VRII pickup playing a loud passage on an LP record. DC voltages noted are VTVM readings to ground.

pushing their connecting wires through convenient holes in the chassis board. If you arrange them either parallel or at right angles to each other, the finished job will have a professional appearance.

Make the connections, for the sake of convenience, as shown in the pictorial wiring diagram, before you do any soldering. Use insulated sleeving over any bare wires that might touch. Flea clips can be used for terminals where several wires come to a common point. Be sure to observe the proper polarity in connecting the electrolytic condenser.

When you have finished wiring the chassis, recheck all connections to be sure they are correct, and securely soldered.

Prepare the metal box for mounting the chassis, battery holders, switch, input socket and output cable. Mount the switch through a hole in the front half of the box (that's the half with the flanges). The phono socket mounts in the end of the box that will be near the input to the chassis. Drill a ⅜" hole in the other end of the box for the output cable. Mount the battery holders in the back half of the box so the batteries will clear the chassis when the two halves are put together.

With these parts in place, the chassis can now be mounted, using a couple of homemade angle brackets to secure it to the front of the box. Complete the electrical connections by wiring the plus lead of C1 to the center (hot) terminal of the phono socket and connecting R1 from the center to the ground lug. Connect a wire from the ground lug to the plus tie-point on the chassis as shown in the diagram. Connect the output cable to the output tie-points on the chassis. Use flexible wire to complete the connections from the battery to the switch and chassis.

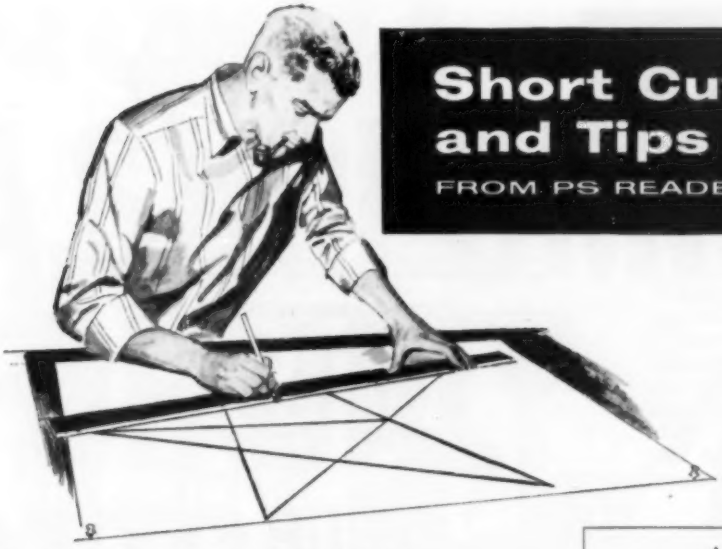
Insert the transistors into the proper sockets. Be sure to get the leads in the proper holes. The base lead (B) is always in the center; the collector lead (C) is identified by a red dot either on the wire or on the case adjacent to the wire—or, in some cases, by being spaced farther from the base lead.

This completes the construction. Put the halves of the box together and your hum-free, noise-free pre-amp is ready for work.—*Tracy Diers and Daniel Cronin.*

PARTS LIST FOR TRANSISTOR PRE-AMP

(All resistors ½ watt)

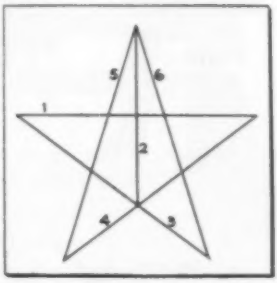
R1:6,800 ohms
R2:27,000 ohms
R3:47,000 ohms
R4:10,000 ohms
R5:200 ohms
R6:8,200 ohms
R7:220,000 ohms
R8:10,000 ohms
R9:6,800 ohms
R10:500 ohms
R11:14,000 ohms
C1:10 mfd. } *15-volt electrolytic capacitors*
C2:160 mfd.
C3:2 mfd.
C4:160 mfd.
C5:.05 mfd. } *ceramic capacitors*
C6:.02 mfd.
TR1:2N133A Raytheon transistor
TR2:2N130A Raytheon transistor
2 six-volt batteries, Burgess Z4 or RCA VS068
1 off-on switch, any type
2 battery holders (Lafayette part MS175)
1 perforated chassis board, 3"x5" (Lafayette MS305)
1 metal box, approx. 3"x4"x5" (Minibox CU2105)
2 transistor sockets
1 phono socket
1 pkg. flea clips (Lafayette MS-263)



Short Cuts and Tips

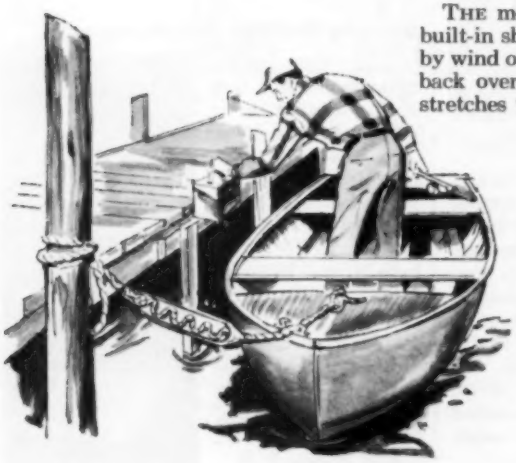
FROM PS READERS

How to Draw a Five-Pointed Star



HERE'S an easy way to draw a star. Rule a horizontal line first; this sets the scale. Then draw a vertical line through the midpoint of the horizontal one. This second line should be ¾ as long as the first, with its midpoint at the intersection of the two lines. Draw the last four lines in order, each as long as the first. The result, though not geometrically exact, makes a good star for decorative purposes.—*T. N. Ferren, Lynnfield Center, Mass.*

Shockproof a Mooring Line



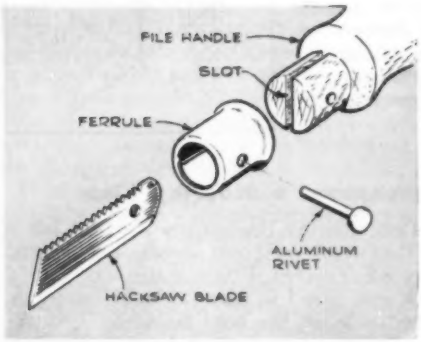
THE mooring line on my rowboat has a built-in shock cord that absorbs jolts caused by wind or waves. A bicycle-tire tube, pulled back over itself to give it double strength, stretches when the boat bounces.

I tie a knot in the line near one end and pull the doubled tube over it, letting the tube overlap the knot by 3″. Whipping the overlapped section with strong cord, I shove slack line into the tube and tie another knot. I finish the operation with a second whipping beyond this knot and smear some waterproofing compound where the line enters the tube.—*Martin Stockel, Miranda, Cal.*

Short Cuts and Tips

Extra Bookshelf in Kneehole Desk

PRESSED for book storage space, I added a 14-volume shelf to my kneehole desk. The bookshelf rests on cleats screwed to the drawer sections. Molding along the shelf's rear edge keeps books from being pushed off. —*R. M. Woodbury, Natick, Mass.*



Making Knife from Saw Blade

CAUGHT without a linoleum knife, I made one quickly by fastening a piece of hacksaw blade to a file handle. I cut a slot in the narrow end of the handle, first pulling off the ferrule. The blade end went into the slot and the ferrule was replaced. I drilled a hole through the ferrule and the wood that lined up with the hole already in the hacksaw blade. An aluminum rivet driven into the hole joined everything together. Then I sharpened the back of the blade to a razor edge. —*S. J. Wilson, N. Hollywood, Cal.*

▶▶▶TO TIGHTEN a loose pick handle, slip the head off and wrap a strip of fine wire screening around the handle where the head fits. Then drive the head firmly onto the handle, sandwiching the wire between them. The wire will dig into the wood and hold the head on tightly. —*Bruce J. Compton, Reno, Nev.*

Simple Holder for Recipes

YOU can easily mass-produce this recipe holder as a gift or bazaar item. The base is a 2½"-by-2½" square of ¾" pine, beveled decoratively on the top edges. Drill a $\frac{3}{16}$" hole in the base for a 6" dowel. With two #8 screw eyes, fasten a spring-grip clothespin to the dowel. Squeeze screw eyes tightly closed for a snug fit.—*J. W. Rocke, Huron, S. D.*

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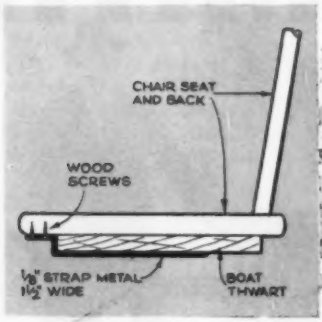
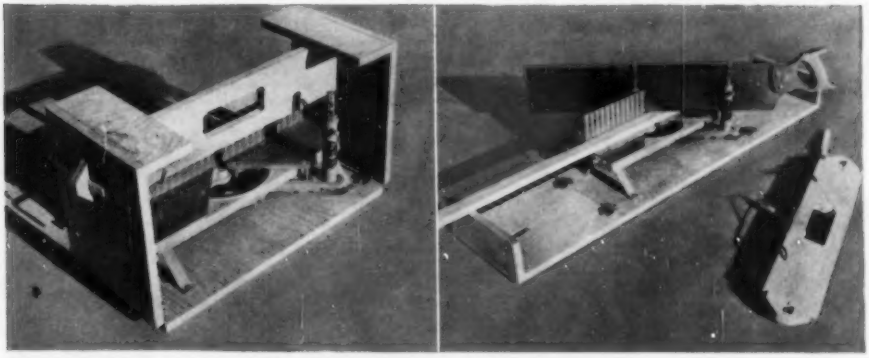
Short Cuts and Tips



Fisherman's Easy Chair

SITTING on a boat thwart for long becomes uncomfortable. You can make your next fishing trip a lot more enjoyable by taking along a chair with the legs cut off. Metal straps screwed to the chair bottom slip under a thwart and hold the chair firmly, making it safe as well as comfortable.



How to Make a Case for Carrying a Miter Box

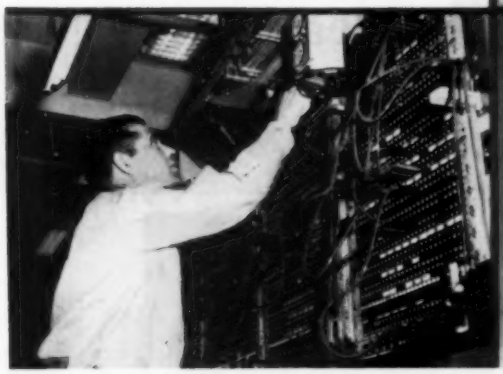
AN OPEN case you can build around a miter box protects it, makes it easy to carry and helps support long pieces of work, like molding strips.

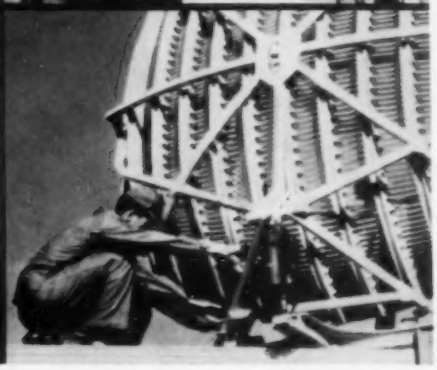
Cut the 3/4"-plywood bottom a few inches longer and wider than the miter box and fasten the two ends to the bottom with hinges. Cut tenons with tapered ends in the carrying handle and cut slots in the end pieces to fit them. After attaching the handle, cut square holes in the tenons for locking pegs.

Tie the pegs to the handle with pieces of shoelace, leaving some slack. The two short pieces that overhang the handle at each end need special attention. When the ends of the case are opened out flat, these supports should be level with the miter box bed so they can hold long pieces.—*Don Engdahl, Santa Rosa, Cal.*

FORMER SERVICEMEN

IF YOU HAVE A TECHNICAL SPECIALTY





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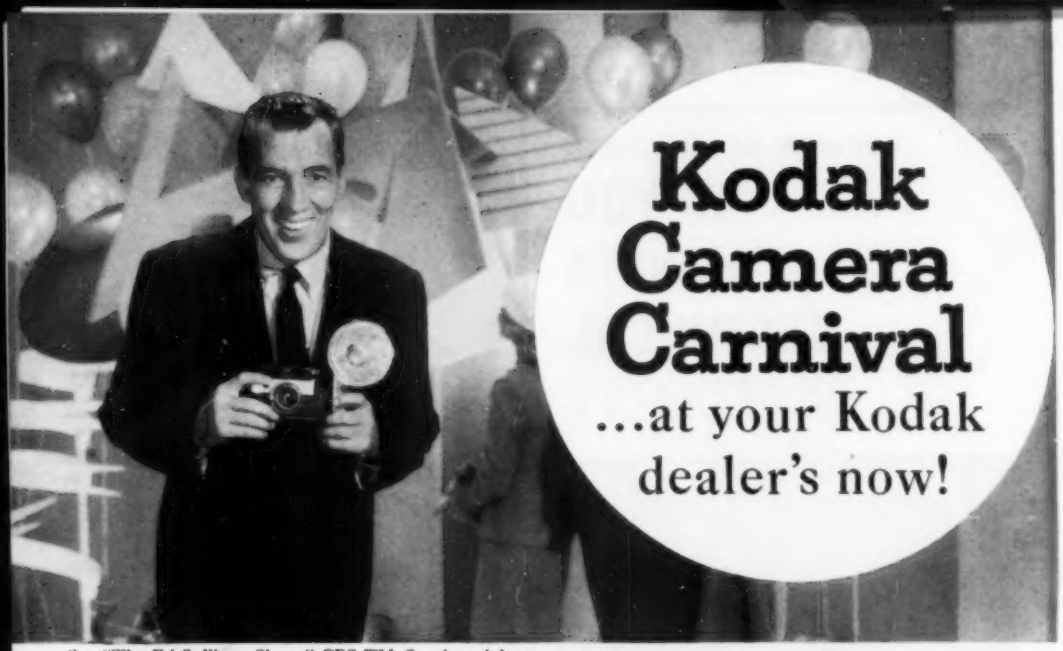


See "The Ed Sullivan Show," CBS-TV, Sunday nights.

New Brownie Starflash Camera takes *color slides* as well as black-and-white and color snapshots. Built-in flasholder. Double exposure prevention. Brownie Starflash Camera, $8.95 or $1 down.

New Brownie Starflex Camera has hooded viewfinder, takes color slides and snaps. Brownie Starflex Camera, $10.75. Kodak Rotary Flasholder shoots six bulbs without reloading, from $10.95.

See your shot big and clear before you snap it with hooded viewfinder on Kodak's Duaflex IV Camera. Fast, pre-focused Kodet lens. Kodak Duaflex IV Camera, $17.95 or $2 down.

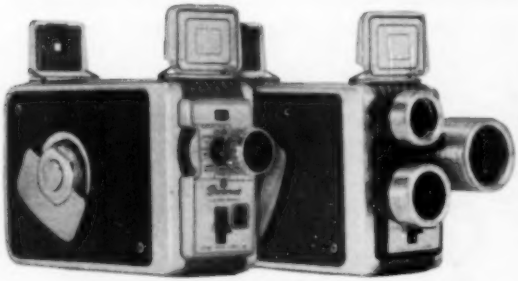
New Kodak Pony II Camera for 35mm color slides. Just dial for picture you want. Make one setting, shoot. Kodak Pony II Camera, $26.75 or $2.75 down. New Kodak Generator Flasholder works without batteries! At your photo dealer's soon.

New Kodak Signet 50 Camera for precision photography has built-in photoelectric exposure meter. Extremely fine *f*/2.8 lens. Flasholder, two reflectors. Kodak Signet 50 Camera, complete, $82.50 or $8.50 down.

Prices are list, include Federal Tax and are subject to change without notice.

Kodak TV stars invite you to the most exciting photo show ever...

See "The Adventures of Ozzie and Harriet," ABC-TV.



Brownie Movie Camera, *f*/2.3 (left), takes color movies with snapshot ease. Just make one setting . . . aim . . . and shoot! Brownie Movie Camera, Turret *f*/1.9 (right), gives you 3-lens range at 1-lens price —takes normal, wide-angle, telephoto shots. Brownie Movie Cameras from $29.95 or $3 down.

Big screen 8mm movies. You show 8mm movies 3 feet wide with Brownie 300 Movie Projector (left). Shows single frames, reverse-action. $6.50 down. Brownie 300 Movie Projector, $64.95. For extra-large-screen movies 5 feet wide, the Cine-Kodak Showtime 8 Projector (right), $123.50 or $12.50 down.

New Kodak Medallion 8 Movie Camera, *f*/1.9, loads in 3 seconds with film magazine, weighs only 23 ounces. Kodak Medallion 8 Movie Camera, *f*/1.9, $106.50.

Shows color slides big-as-life. Kodak 300 Projector is only 5 inches high, easy to carry as a portable radio. Kodak 300 Projector, $64.50 or $6.50 down. New Kodak Cavalcade Projector shows slides *automatically!* You turn it on . . . it does the rest. At your dealer's soon!

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Short Cuts and Tips

How I Got Rid of Soggy Soap Cakes

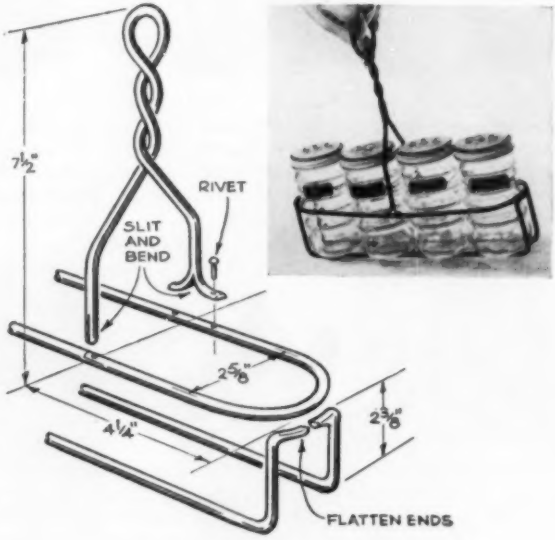
I PRESS a beverage-bottle cap into each new cake of soap before leaving it in the soap dish. This keeps the cake out of water, where it used to become soggy. As a heavy soap user (I am a surgeon) I find that each cake of soap so protected lasts an average of 25% longer than the unprotected ones used to last.—*Dr. Coen Oosthuysen, Vereeniging, Union of South Africa.*

▶▶▶SPRAYING oil on tools is the easiest way to keep a basementful of them rust-free. I buy a quart of lubricating oil for about 50¢ and a dispenser bottle made to hold window-cleaning fluid costs less than that. The oil spurts out in a fine spray, instead of a stream, if one part wood alcohol is mixed with every four parts of oil. Evaporation removes the alcohol quickly, but beware of using an open flame immediately after spraying.—*Col. J. A. Anderson, Washington, D. C.*

This Spice Rack Needs No Welding

SPICE jars from the five-and-ten make an attractive set when racked in a wire holder. You can make a holder from 3/16″ brazing rod, which is sold in 3-foot lengths at many hardware and auto-supply stores.

Bring the ends of the jar-encircling strip together in a lap joint and rivet them. Then bend the ends of the base rods, flatten and rivet them together too. Form an eye in the handle and slot its ends with a hacksaw. The halves that are formed by this slotting are then bent out flat and riveted securely to the base of the rack.—*Sam Grant, NYC.*



HOW TO BE A GASOLINE MONEY SAVER

"SAVE MONEY as you drive," says George, the gasoline saver . . . claims he puts a lot of extra spending money in his pocket with what *he* saves on gasoline . . . in ways like these:

He keeps his engine tuned . . . plugs clean for full firing . . . distributor points and breaker gap clean and correctly set . . . air cleaner unchoked by dirt, a free-working, properly adjusted automatic choke valve to avoid an over-rich mixture.

He saves as he drives. Avoids gasoline-wasting jack rabbit starts and unnecessary spurts and slow-downs . . . coasts up to red lights with minimum braking . . . shuts off his engine instead of costly idling.

Other gasoline saving factors—fully inflated tires and aligned wheels push easier . . . the right engine oil (see below) saves starting and running drag . . . a car needs more than three times the power to do 70 instead of 35 and gives less than half the economy. "Also," says he, "I get top mileage with Texaco Sky Chief Su-preme gasoline."

Four to forget—just one to remember

Now you can forget about motor oil grades. New all-temperature Havoline Special 10W-30 combines the advantages of 4 grades in one. Your car always gets full-bodied, free-flowing lubrication under *every driving condition*—cold starts—intense heat—any climate—any season. Now . . . Havoline "thinks for itself" to save your thinking about seasonal grades. Also cleans as you drive to wear-proof your engine. Get it from your Texaco Dealer, *the best friend your car has ever had.*

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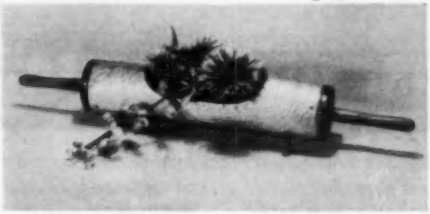
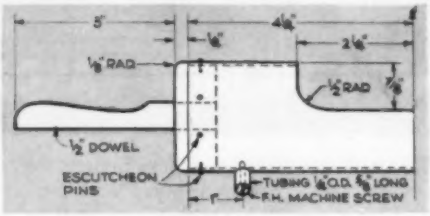
Short Cuts and Tips

Spread Your Mortar with a Calking Gun

It's easy now to point up the brickwork of a chimney. I squeeze mortar from a used cartridge-type calking gun. I mix the mortar to a smooth consistency and first thoroughly wet down the section to be repaired. —*Joseph J. Papp, Dayton, O.*





Kitchen Planter Shaped Like a Rolling Pin

This rolling-pin planter filled with a small-rooted house plant or artificial foliage makes a cheerful corner-filler for the kitchen or dining nook.

Make it from an 8½" length of 2" copper or aluminum tubing. File ends square and cut out the plant opening with a coping saw. File the cut edges smooth and finish with emery paper. Slide the tube over a round metal bar to back it up, then emboss the surface with a hammer.

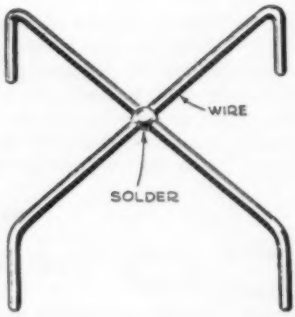
Turn the two end pieces from ¾" maple and drill holes in them for handles turned from pieces of ½" dowel. Use escutcheon pins to hold ends in the tube.

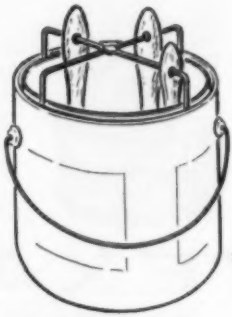
Make legs from ¼" tubing and flathead machine screws, and fasten them in holes tapped in the bottom of the planter.

Polish metal parts, stain the ends and apply clear lacquer overall. Coat with asphaltum inside for use with live plants. —*R. J. DeCristoforo, Los Altos, Cal.*

Wire Frame for Hanging Brushes

A brush cleaner works best if brushes are suspended above the container bottom. You can make a frame by soldering or tying two pieces of coat-hanger wire together. Drill holes in the brush handles, big enough so that they can slip around wire bends.—*W. B. Eagan, Floyds Knobs, Ind.*





IN TOWN TRAFFIC . . . *some spark plugs, designed for high speeds, become fouled and cause misfiring and loss of power when driven at low speeds.*

ON THE HIGHWAY . . . *some spark plugs, designed for low speeds, misfire causing power loss and invite destructive pre-ignition when driven at high speeds. Why gamble when . . .*

Auto-Lite Resistor Spark Plugs with POWER TIP

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If you drive at both town-traffic and highway speeds, here's why you should use Power Tip . . . the first spark plug ignition-engineered for today's engines and today's driving.

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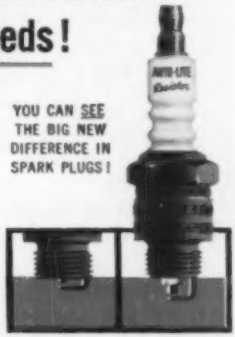

Ordinary Tip **Power Tip**

Power Tip protrudes farther into the combustion chamber for better ignition. Fuel burns more evenly and completely to give top performance and economy at *all speeds.*

At low speeds, the projecting Power Tip is in the thick of combustion where it gets hot quicker and stays hot to burn fouling deposits away *clean.* At higher speeds, the projecting tip is in the path of the incoming air-fuel mixture where it stays cooler to effectively *check* power-robbing pre-ignition. Ask your garage or service station to install Auto-Lite . . . the *only* spark plugs with Power Tip . . . and start enjoying top performance and economy from your car at *all speeds.*

*Power Tip, with or without Resistor, is ignition-engineered for overhead-valve V-8 engines and for most overhead-valve 6-cylinder engines in all these cars—Buick, Cadillac, Chevrolet, Chrysler, De Soto, Dodge, Edsel, Ford, Hudson, Imperial, Lincoln, Mercury, Oldsmobile, Nash, Packard, Plymouth, Pontiac, Rambler, Studebaker.

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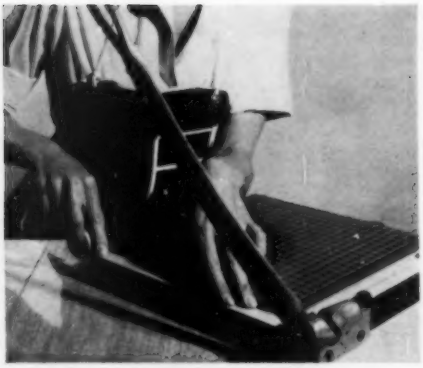
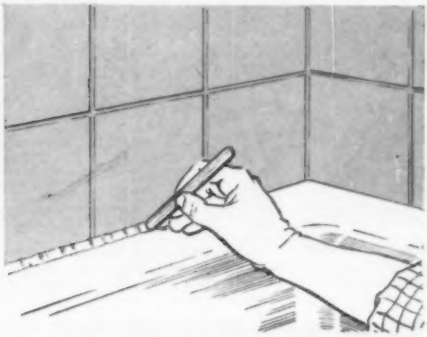
Auto-Lite makes a complete line of spark plugs, including Standard, Resistor, Small-Engine, Transport, Aircraft, and Diesel-Starting.

Short Cuts and Tips

How to Skid-Proof a Trimmer

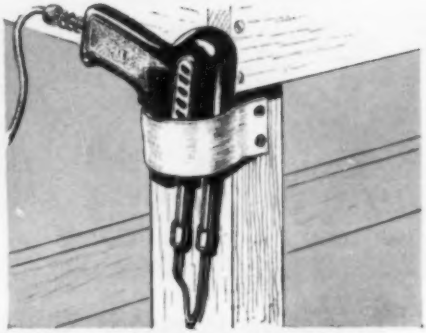
MANY a print is ruined because it slips as the trimmer blade is coming down for the cut. Slipping can be largely eliminated by sticking a strip of masking tape, as a hold-fast, along the board's edge.—*Eugene M. Hanson, Los Angeles.*





Filling Cracks in a Tiled Wall

ALL I use to repair cracks between the bathtub and the tiled wall is some grout and an ice-cream stick. I push grout into the cracks and smooth it into a neat fillet with the curved end of the stick.—*Paul S. Lederer, Silver Spring, Md.*



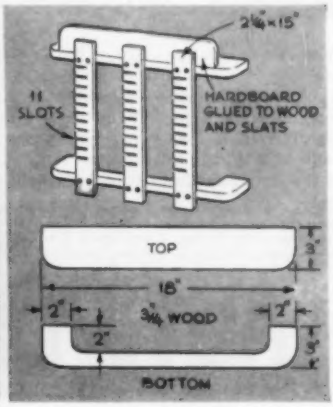
Holster That Soldering Gun

ALWAYS handy for a quick draw, my soldering gun slips into a workbench holster. I made the holster by nailing a strip of leather to one of the bench legs; some toy gun holsters would work as well. —*J. C. Branstetter, Colma, Cal.*

This Rack Holds Both Kinds of Ties

THREE "ladders"—slotted strips of hardboard screwed to wood crosspieces—make this tie rack. Cut 1/8" kerfs in each strip with a dado blade, or cut pairs of kerfs with a handsaw and chip out the ends.

If you're mounting the rack on a flush door, the lower crosspieces must be U-shaped for tie clearance. Face the upper crosspiece with a strip of hardboard to hold clip-on bow ties.



These men chose from 127 courses— so can you!

Pvt. Ted W. Gill
Comstock, Texas
Graduate, Comstock High School

"I'm getting the engineering training I wanted, thanks to the Army's technical training program for high school graduates. My Army Recruiter showed me all the different courses I could pick from. I chose Construction Surveying. The course was even better than I thought it would be. If you'd like to pick just the training you want, the Army sure offers you the best deal."

Pvt. Kenichi Isagawa
Maui, Territory of Hawaii
Graduate, Baldwin High School

"If you're not going to college, the best way for a high school graduate to get just the training he wants is to enlist for the Army's technical training program. I picked a Metal-working course and learned the trade I wanted. Now I'm working right in my field. Only the Army offers you choice of schooling, so find out about it from your Army Recruiter."

Seniors—get all the details on how high school graduates can choose their technical training before enlistment from 127 modern courses. Mail this coupon for your free booklet today. Or for immediate counseling visit your local Army Recruiter. He's listed in the phone book and will give you all the facts—at no obligation!

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Please send me the free Army booklet telling how high school graduates can choose their technical training before enlistment in Modern Army Green.

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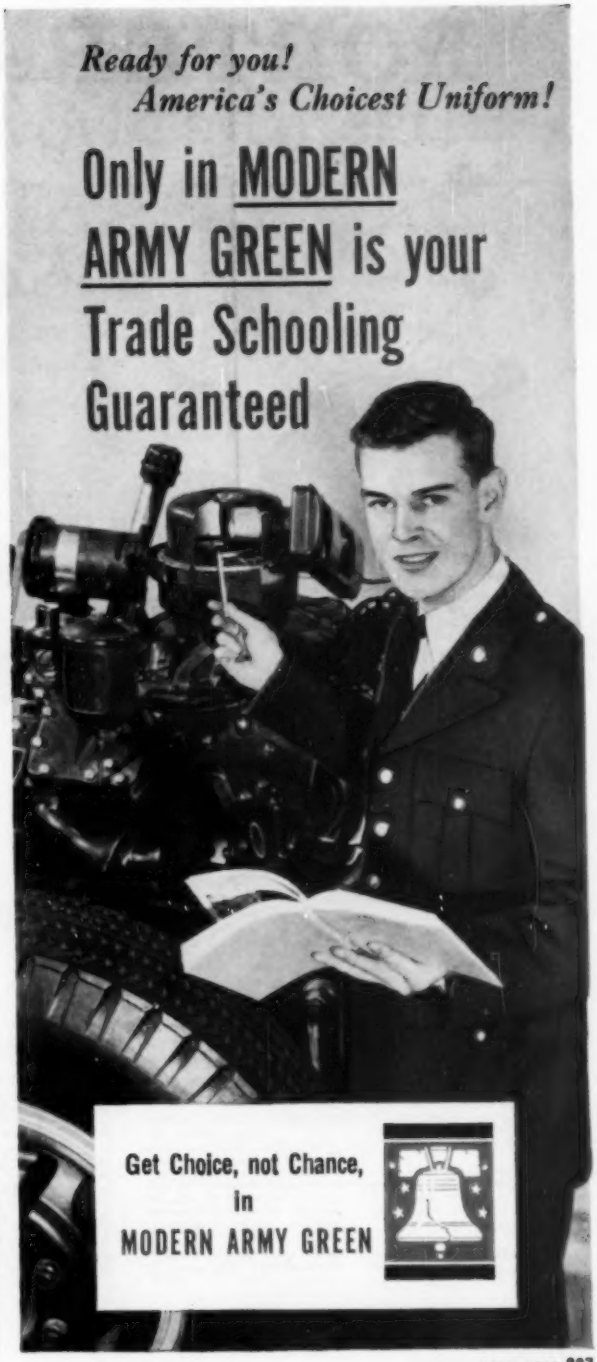
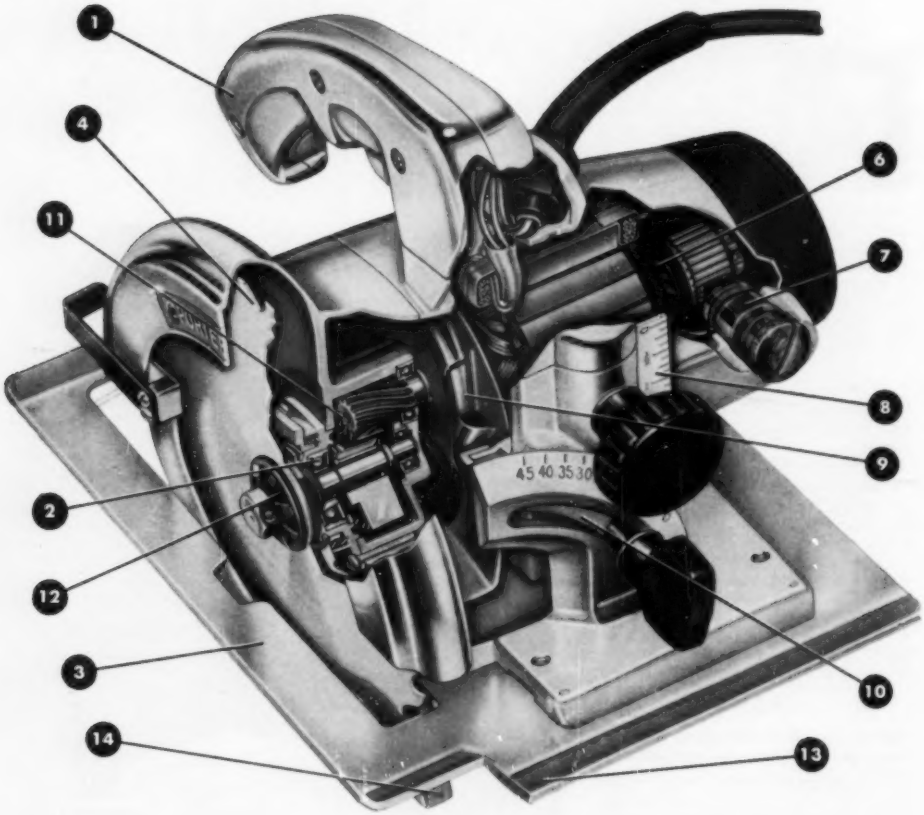


PORTER-CABLE



1 BALANCE – Comfortable, contoured handle is specially designed and located for easy one-hand operation and for operator comfort on every cut . . . in any position!

2 PRECISION BALL BEARINGS – Heavy-duty, oversize ball bearings are used THROUGHOUT; grease packed at factory for life time trouble-free service.

3 WIDE WRAP-AROUND BASE – Heavy-duty machined base projects on both sides of blade to provide full support and greater stability on cuts from either direction.

4 CHROME-PLATED BLADE – Chrome plating gives blade extra-hard cutting edge for longer life. Standard equipment on all new models.

5 GEAR LUBRICATOR – Keeps gear chamber well lubricated without having to dismantle saw. Simple twist of cup ring injects grease onto gear and pinion. (Not shown on drawing.)

6 PRECISION MACHINE-WOUND ARMATURE – Features a newly-developed winding technique which assures identical electrical and physical characteristics of the coils. Coils are nylon-clad and insulated for maximum power and top performance.

7 HEAVY-DUTY BRUSHES AND BRUSH MECHANISM – Spring-loaded cartridge type brushes are self-adjusting. Specially designed for better commutation and peak performance.

8 CALIBRATED DEPTH SCALE – Eliminates guesswork. Simply loosen depth adjustment knob and instantly raise or lower saw to desired depth as indicated on the scale.

9 DUST BLOWER – Specially designed to maintain high efficiency of motor and keep cutting line clear.

10 PRECISION ANGLE SEGMENT – Quick and easy to set for accurate bevel cutting from 0° to 45°. Weight of saw is held by heavy die castings at any depth or angle setting.

11 PRECISION MACHINED GEARS – Hardened for greater tooth strength, larger contact area, peak performance and longer life.

12 KICKPROOF CLUTCH – Eliminates kickback. Protects operator. Prevents motor and switch burnout.

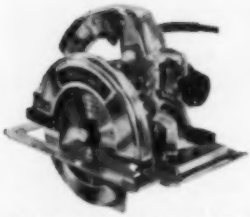
13 SINGLE LINE OF CUT – Only one sighting line to follow on any cut – whether straight, angle or bevel.

14 SAFETY "NO-DRAG" GUARD – Patented miterlip on leading edge prevents jamming at start of any cut, and eliminates "drag" during the cut. Positive action of new coil spring returns guard immediately after cut is completed.

SAWS

are the world's finest...

HERE'S WHY: When it comes to designing a **better** saw – you can depend on Porter-Cable to do it—and do it first! Typical of Porter-Cable's fifty years of leadership are these three models—the newest additions to the famous line of Porter-Cable saws. Today, more than ever, it pays to see these quality saws at your Porter-Cable dealer. You'll get more cutting power... more satisfactory use... more professional features... more lasting value... at special low introductory prices!



LIGHTWEIGHT 6½" SAW

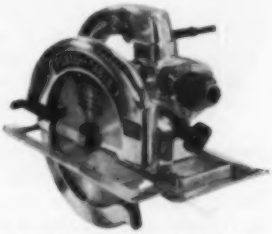
A 6½" lightweight saw with full professional construction. 10-amp. motor for rugged cutting jobs. Perfect for all framing and roughing cuts. **Model 146A $69.50**

146A Saw, in handy Builder Kit, with rip guide for fast, accurate ripping and steel carrying case. **Model 146Ak Saw Kit $83.50**

RUGGED 7" SAW

A rugged 7" all-purpose saw with a full 12-amp. motor to give you power and speed usually found only in higher priced saws. Provides trouble-free, dependable service on every type of cutting job. **Model 115A $79.50**

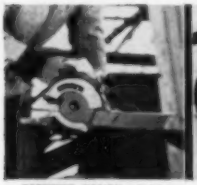
115A Saw, in handy Builder Kit, with rip guide for fast, accurate ripping and steel carrying case. **Model 115Ak Saw Kit $93.50**



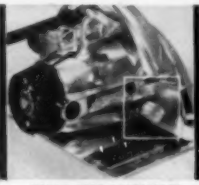
HEAVY-DUTY 8¼" SAW

A low-priced, heavy-duty 8¼" saw with rugged 13-amp. motor. Designed especially for the builder who wants added power with big cutting capacity. Safety features include auxiliary front blade guard. **Model 168 $99.50**

168 Saw, in handy Builder Kit, with rip guide for fast, accurate ripping and steel carrying case. **Model 168K Saw Kit $113.50**

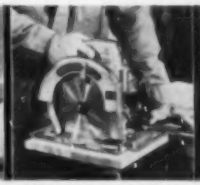


PATENTED DESIGN of telescoping guard eliminates jamming and "drag" during any cut, even compound miter.



HANDY GEAR LUBRICATOR keeps gear and pinion well lubricated without having to take saw apart.

EASY TO HANDLE on any cut – because of light weight and balance. Ideal for cut-off and trimming operations.



EXCLUSIVE auxiliary front blade guard, on Model 168 only, covers saw teeth even on shallow cuts.

ABRASIVE BLADES are available for cutting metal, stone, masonry, plastics and other problem materials.

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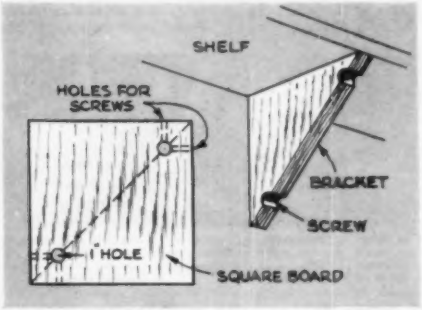
Short Cuts and Tips

Backfill Attachment for Garden Tractor

FURROWING the garden for potato planting is a cinch with the garden tractor. But I still had to backfill with a hoe. Now I've mechanized this unpleasant job by replacing the plow with my own V-shaped attachment when the time comes to close the furrows. —*Mark Collier, Durant, Iowa.*

▶▶▶HERE'S an easy way to mark a sill for the anchor bolts that are set in masonry slabs or walls. Daub paint on the bolt ends and set the wood sill down on top of them, positioned as for installation. Lift the sill off and drill bolt holes precisely where the paint marks are.—*Blanche Campbell, Las Vegas, Nev.*

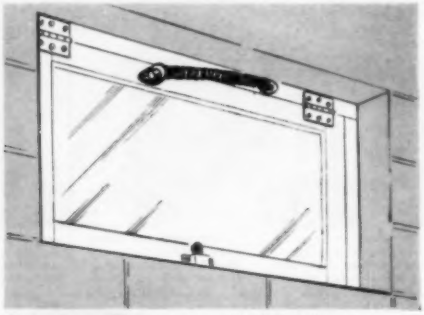
▶▶▶TO SPLICE broken structural tubing I use a length of slightly smaller diameter as a dowel pin. I weld four beads along this pin, spacing them equidistantly. After driving the pin into both openings in the broken tubing, I weld the broken edges together for a quick, effective fix. —*Forest W. Stoll, Marshallville, Ohio.*



Make Shelf Brackets by the Pair

NEXT time you need shelf brackets, make them two at a time from a square of scrap wood. Draw a diagonal line on the board's face and drill two 1″-diameter holes through it, centered on the line and spaced 2″ in from a corner.

Then drill screw holes in the edge of the board, a pair for each hole in the face. Cut the board along the diagonal line and anchor the brackets with screws driven through the predrilled holes.



Taming Basement Windows

YOU can control those slamming transom-type basement windows with a spring used for closing screen doors. Mount it on the inside of each window, and wind it so its tension acts as a counterbalance to the window's weight. In this way, the spring will tend to open rather than close the window, making it easier to handle and incidentally avoiding the occasional mishap of having it slam shut.—*Andy Vena, Philadelphia, Pa.*

Only a Screw holds like a Screw

Experienced craftsmen know that nothing can take the place of a screw for holding power. For every project in which permanence, quality and beauty is desired—be sure you have plenty of precision-made Southern Screws on hand.

Leading hardware or building supply dealers everywhere stock the Southern fastener line. In addition most boating supply stores carry Southern's line of non-corrosive screws . . . including brass, Everdur silicon bronze, aluminum, stainless, chrome plated brass, and hot-galvanized steel. Check your supply of slotted and phillips screws now—and when you buy be sure to specify Southern. Buy 'em by the name—buy 'em by the box and save!

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MACHINE SCREWS & NUTS
CARRIAGE BOLTS
HANGER BOLTS
DRIVE SCREWS
DOWEL SCREWS

Short Cuts and Tips

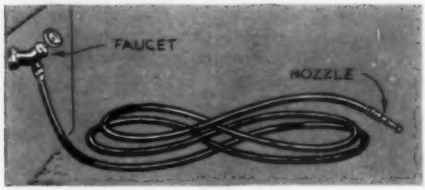
Make a Barbecue Double as Tea Cart

SHORT of storage space for my barbecue, I turned it into a mobile table for the living room. I removed the grate and set a plywood table top made for the purpose over the grill. My neighbors like the idea and have made the same wintertime conversion on their barbecues.—*Capt. Fred N. Ozment Jr., Fort Sill, Okla.*

▶▶▶ON PICNICS and trips I cool our portable ice box with hot-water bottles. The rubber bags are filled with ice, made by freezing the water-filled bottles in the refrigerator. They don't leak, so food stays dry. On long trips I wrap each bottle in newspaper; the ice lasts longer that way.—*W. L. Hay, Morristown, Tenn.*

Hat Holder for the Car

A GOOD way to carry your hat in the car is to suspend it from the ceiling with rubber bands attached to drapery hooks. Each of the hat-holding straps consists of three rubber bands tied together.—*O. A. Nelson, Seattle.*



Coiled Hose Won't Kink

WHEN the garden hose is in frequent use, I coil it down between times in a figure-eight pattern. This prevents kinking and you'll find that it is an even faster method than winding the hose on a reel.—*Preston Stedman, Kingsville, Tex.*

Drawer Stop from a Washer

LOST the staple-shaped stops that keep cabinet drawers from dropping out on your toes? Make new ones from ¾" O.D. washers and drive them into holes left in the front rails by the original stops. —*A. J. Field, San Francisco.*

All you need for Spring Spruce-up... all in one handy *MoPar* kit...all for $2.25*!

Special package price! For sparkling "new car" beauty, here's what you get in one easy-to-take-with-you, easy-to-use car care kit:

1. MoPar Automobile Polish. Fast-acting. Just apply, let dry, wipe clean.
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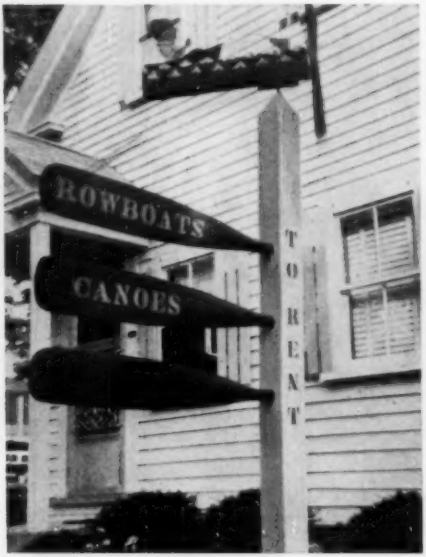
PARTS & ACCESSORIES

Short Cuts and Tips

Candle Reflects from Tin Can

TIRED of carrying a heavy lantern on camping trips? Then split a tin can down the front and part way around the bottom. Bend the side pieces open and stick a candle inside, as shown at right.—*Michael O'Higgins, Arlington, Va.*



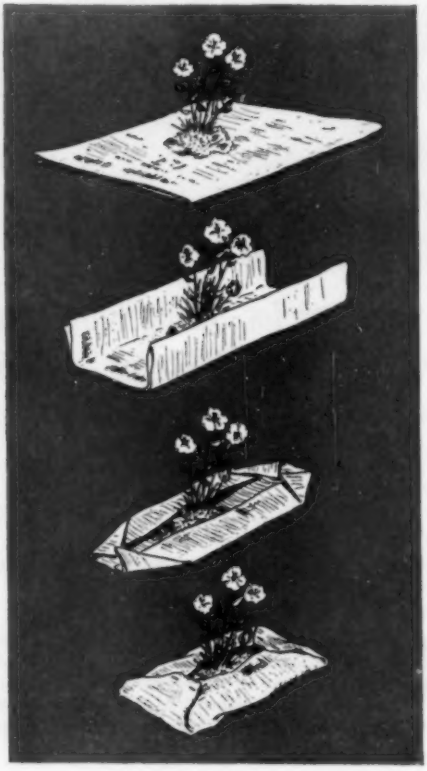
Signs Have a Nautical Flavor

DON'T throw away broken canoe paddles or oars. The blades can make salty signboards for your name or a business message.—*John Morgan, Holbrook, Mass.*

Moving Seedlings with Safety

SHIFTING small plants without losing the soil around the roots takes only some newspaper and a stapler. Fold two sheets of the paper in half and place the dug-up plants in the center. Then fold the paper around the roots, as shown, staple the ends, and replant the seedlings with the paper.—*Ralph Wilkes, Keuka Park, N. Y.*

▶▶▶I REPAIR holes in window screens and in screen doors with a large needle and some stout thread. Sewing the patch on, I have found, is easier, and also makes a much neater job, than wiring it in place. —*Mrs. Monty Koslover, Watertown, Mass.*



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Find Your B&D Dealer in the "Yellow Pages"

Look under "Tools-Electric"

Black & Decker®

World's Largest Maker of Electric Tools

We Took a Houseboat Vacation

[*Continued from page 117*]

river became home after a few days and we forgot the frantic pace of city living.

No special equipment was necessary. We took plenty of food for easily prepared meals. Along the river we picked up fresh sweet corn, tomatoes and cold watermelons to fill in. A charcoal burner made shore picnics easy. Two mattresses from roll-away beds made comfortable sleeping places for the children when spread out on the cabin floor.

River travel was new to me, as it was to my wife and three children, six, eight and 10 years old. Locking a boat through the many dams was a mystery at first. And we had to learn the simple rules of river traffic. Actually, becoming a river captain was a big part of the fun. I found satisfaction in docking the boat gently, navigating the locks like an old-timer and maneuvering safely among other boats.

We laid out our route beforehand on a set of river charts bought from the Army's Corps of Engineers. Marked on the charts in great detail were channels, sand bars, buoys, dams and mileage markers. We found these road maps of the river worth much more than their $3 cost.

Shoving off from home port at Mile 446, we headed down the Ohio River. The broad stream was alive with river craft, most of it commercial traffic. The children kept us busy with questions about tugs and barges. Six-year-old Steve, who enjoys a pun, entertained himself by yelling "Hi, boy" at every river buoy we passed.

In a day and a half we had gone 100 miles, to Carrollton on the Kentucky side. Here we turned into the Kentucky River, one of America's most beautiful small waterways.

Deep and green, the Kentucky winds back into the hills between high cliffs. It has fine fishing and 10 ancient dams that are still hand-operated by "lock-masters." Sixty-five miles upriver we tied up at Boat Club Harbor and went ashore for a restaurant meal. A sightseeing trip to the state Capitol and the governor's mansion gave the children a needed change in routine.

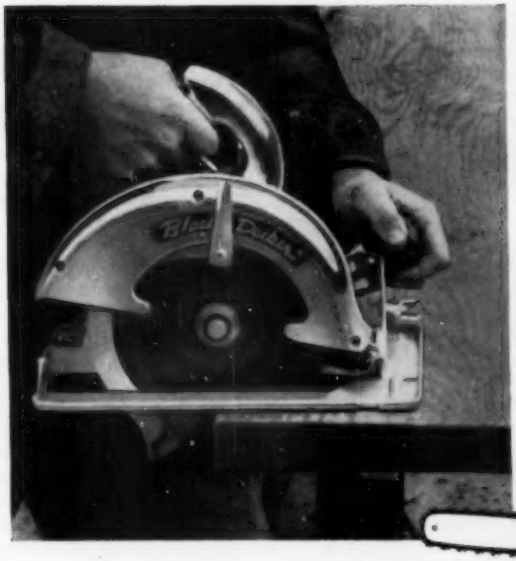
Continuing on up the Kentucky we passed under high bridges, loafed by small farms and little crossroads villages. Well above Frankfort we turned into the

EASIER HANDLING—Lightness and balance, easy adjustments, safety features give the operator better control in the wood.

MORE POWER—Cool running B&D-built motor is custom engineered for abundant power on a variety of sawing jobs.

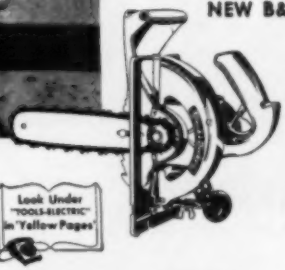
BETTER VISIBILITY — Black & Decker's exclusive picture-window view, double guide lines insure line-of-cut accuracy.

HERE'S WHY BLACK & DECKER SAWS ARE TOO TOUGH TO BEAT!



The features of a product establish its quality, performance, satisfaction! And the features of Black & Decker Saws assure you the fastest, easiest sawing you've ever done! Those same features enabled a B&D Saw to stand up to an independent laboratory's 7-Day Torture Test . . . to run continuously for one full week . . . to take more punishment than most saws ever get in a lifetime of use!

Try a B&D Saw at your dealer's now. Check its construction, heft it, pull the trigger and feel the surge of power. See for yourself why Black & Decker Saws give best performance, value, versatility.



NEW B&D CHAIN SAW ATTACHMENT

Cuts trees, timber, beams, heavy planking, stacked lumber. Cuts any position—overhead, notching, etc. Heavyweight performance, maximum versatility . . . safe, fast. Fits B&D #73, #83 Saws.

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Most likely your wife wouldn't react this way. But if oil consumption has been a problem in your car, the results with Sealed Power's new stainless steel* oil ring have been so phenomenal she might be tempted. Even under high vacuum conditions such as deceleration, even when cylinder condition is poor, KromeX ring sets with this new oil ring deliver absolute oil control . . . immediately save you money you've been spending for oil.

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This oil ring resists sludging and clogging because of the unique characteristics of stainless steel. And Sealed Power's stainless steel oil ring has chrome-plated steel side rails for more than double the life you'd expect. You can't do more for your car at less cost to yourself. Ask for Sealed Power.

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Sealed Power

PISTON RINGS

BEST IN NEW CARS! • BEST IN OLD CARS!

mouth of the narrow, swift-flowing Dix River. This would be a short side trip to add spice to adventure.

I had heard that big rocks were hidden beneath the surface of this river and planned to go in only a short distance for a look at the rocky cliffs. The waters began to look more and more treacherous, so I started to wheel her about to head back for the Kentucky River.

I put pressure on the wheel and it whipped around crazily. The steering cables had pulled loose and the boat was drifting aimlessly in the narrow gorge. Using clutch and throttle I edged her into the bank and snubbed her to a stump. Before long I found the spot where the cable had slipped loose. I soon had her fixed again and learned an important lesson in the process: Always carry a set of tools for emergencies.

Back in the Kentucky again, we went a short distance farther up. Finally, 125 miles from the Ohio we turned around and headed for home. It was like a completely different trip back; seen from a different angle, the landscape had a new freshness and variety.

Our houseboat vacation cost us no more than an automobile trip of the same duration. Food and soft drinks cost $50. Gasoline—we used a gallon an hour when underway—cost $27. Incidentals like ice, souvenirs, fishing license and river charts added $13. Totaling it all up, including $160 for boat rental, we had spent $250 on a 10-day vacation for five.

No boat dock had charged us for water. And on three nights we even made fast to boat docks for the night, with an invitation to plug into shore electricity, free.

We met some families who have pooled their resources to buy a houseboat for from $2,000 to $5,000. One boat was owned and jointly used by no less than three families! END

After the city, before the state,
The zone keeps mail from being late

The Post Office has divided 106 cities into postal-delivery zones to speed mail delivery. Be sure to include zone number when writing to these cities; be sure to include your zone number in your return address—after the city, before the state.

New in the way it looks . . . in the way it feels —Chevy's Turbo-Thrust V8!

Here's an engineering achievement you can feel the instant your toe touches the treadle. You feel a new kind of response—an ultra-smooth pickup. And when you lift that Chevrolet hood you'll see why. You'll see an engine so radical it even looks different. It's the Turbo-Thrust V8. It's built around a revolutionary design that contributes to constant smoothness at all engine speeds and to exceptional efficiency as well.

Turbo-Thrust's combustion chambers are located in the cylinder block rather than in the cylinder head. They're wedge-shaped and precision machined for even, efficient combustion. Since each chamber is precisely the same size, each piston does the same work. The result is a velvet-smooth flow of power from idling speed right on up. A whopping 348 cubic inches of displacement gives you power when you need it—with plenty in reserve. Visit your Chevrolet dealer today. Lift the hood and see the difference . . . take a drive and you'll feel it!

Here's a new kind of get-up-and-go! The 250-h.p. Turbo-Thrust V8—or the 280-h.p. Super Turbo-Thrust V8—is available at extra cost in any Chevrolet. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

Keep your rotary mower blade sharp all summer long for only 98¢

Rotary Mower file by Nicholson lets you sharpen your blade easily. If your machine is engine-operated, disconnect the spark; if electric, unplug cord.

It's a nuisance to drag your rotary mower off to be sharpened several times a season. The grass doesn't stop growing while your machine is away from home. But a new product by Nicholson solves the problem. Our Rotary Mower file is the first tool ever designed specifically for sharpening rotary blades. Best news of all: it sells for only 98¢, and pays for itself the first time you use it.

The Nicholson or Black Diamond Rotary Mower file comes with a handy hang-up hole for easy storage in your shop or garage. And every file comes with its own protective plastic sheath.

Look for it in its colorful display. It's at your hardware dealer's now—the biggest tool bargain you ever came across.

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY** BLACK DIAMOND U.S.A.

Providence 1, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON FILES

A FILE FOR EVERY PURPOSE

Bargain Boats Come in Kits

[*Continued from page 154*]

other highly valuable tool is a portable electric handsaw, which cuts both straight and curved lines, leaves smooth edges and makes shave cuts for precise fitting.

Selecting a motor. Pick the motor for your boat according to the job you want it to do. The kit manufacturer's data will tell you the power range you can use. For water skiing or aquaplaning, you'll usually need at least 15 horsepower.

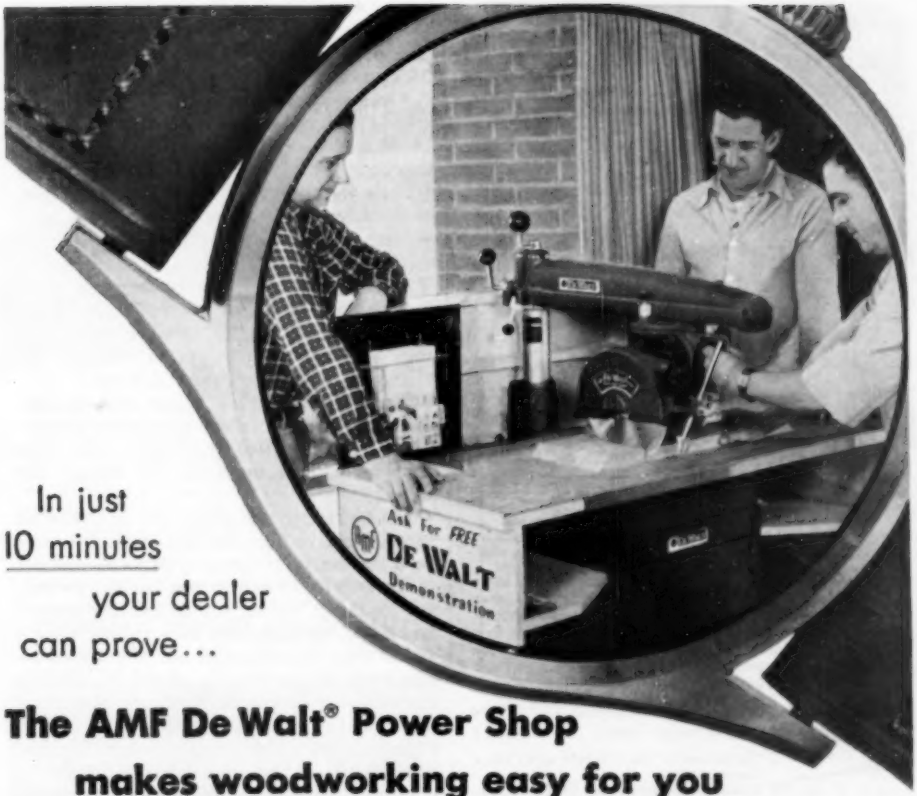
For general use, buy your motor on the basis of the speed you want with the load you'll carry. Lightly loaded (one or two people), a typical 14′ runabout can do 15 m.p.h. on five hp., 23 m.p.h. on 10 hp., 28 m.p.h. on 16 hp., and around 40 m.p.h. on 25 to 40 hp. If you want fast performance with heavier loads, select a higher-powered motor within the range set by the manufacturer.

If you want just enough power for fishing, a small motor will cost less to buy and run, but don't go below the minimum set by the boat maker. With an undersized motor running at capacity, you'll get neither performance nor economy.

Where to build it. The old joke about not being able to get a boat out after it's built is not as far-fetched as it may sound. Merely measuring the width of a doorway is not enough. Make sure there's plenty of clearance to turn corners and navigate stairways.

The garage is usually the best place to assemble a kit as it provides ample working space and wide doors. If the garage isn't heated and the weather is too cool for resin adhesives, the answer is a space heater. It need be used only during the period required for the resin to set properly. It is a good idea, however, to allow time for warming up the parts to be glued.

If your boat is small enough to fit a car-top carrier, you'll save the cost of a trailer, the license fee and the extra insurance that's usually required. Trailer prices range from about $100, for small boats up to 14′, to $350 or more for larger runabouts and cruisers. Many kit makers also sell trailers suited to their own boats. If you leave your boat moored during the summer and need to transport it only in spring and fall, it's usually more economical in this case to rent a trailer. END



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SEE Direct-drive power, no belts, no pulleys

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SEE De Walt becomes 12 professional tools in 1

See for yourself why DeWalt's original radial arm design, big capacity, and unsurpassed accuracy make it the finest, most valuable all-purpose power tool you can own.

Your dealer will quickly show you how a DeWalt saves the cost of a shop full of tools — makes all home woodworking fast, easy, safe... fun! How you can make furniture, build in cabinets, finish off the attic or basement, make home repairs... do all those things you've always wanted, *even if you've never used a power tool before!*

See your Franchised DeWalt Dealer for a Free, *convincing* demonstration today! Easi-Budget Terms — 10% down, 2 years to pay!

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DE WALT POWER TOOLS

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Division of AMERICAN MACHINE & FOUNDRY COMPANY

☐ Send FREE colorful 20-page Booklet and name of dealer.
☐ I enclose $3.95 (check or m.o.) for De Walt woodworking manual.

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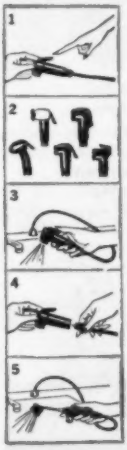
Dish-Quik makes quick work of dishes and a dozen other kitchen tasks! Even scrubs out the sink—yet your hands never touch hot, soapy water! To spray-rinse with hottest water, just press the thumb lever; or, tap the button for an instant flow of rich, foamy suds. Uses any good liquid detergent; holds two-day supply. Rugged, all-nylon brush gets dishes, pots and pans really clean! Fully guaranteed.



DO YOU HAVE A SPRAY THAT CAN BE REPLACED WITH DISH-QUIK?

1. The answer is "yes", if your spray has a thumb-control.
2. Almost all sink sprays have thumb controls. These sprays come in many shapes; are widely used, in nearly 20 million homes.
3. They are called "automatic sprays" because they spray automatically when the thumb control is pressed.
4. It's easy to replace any automatic spray with Dish-Quik. Simply unscrew the old spray.
5. Then attach Dish-Quik to the same hose.

Now it's easy to repair or replace any automatic (thumb-control) spray! Dish-Quik is one of the new, official replacements, standardized to replace any old or worn-out automatic spray. In addition to Dish-Quik, the deluxe replacement, you can also choose Rinse-Quik, the standard replacement, for rinsing only. Replacement hoses and accessories also available. If you do not have a thumb-control spray, you cannot use these replacements. You can, however, install a new kitchen faucet equipped with your choice of Dish-Quik or Rinse-Quik.

Ask for Dish-Quik and Rinse-Quik Wherever Plumbing Goods Are Sold

MAIL COUPON TODAY FOR FREE BOOKLET

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1700 East 58th Place, Los Angeles 1, Calif.
Please send free 16-page booklet telling how to repair and maintain automatic sprays and how to install new kitchen faucets that are equipped with these sprays.

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Guide to '58 Power Mowers

[Continued from page 158]

the obvious need. They are coming, in 1959 most likely.

One approach is to wrap the engine inside a large shroud. One part of the enclosure serves as the silencer, another separate part as a muffler. Liberal use of rubber mounts prevents direct transmission of noise from engine to shroud, also helps quiet clanking of parts.

How to pick a good mower—any year. The chart lists the points to check.

The engine. Type (two-cycle or four-cycle) doesn't matter, but the other factors do. You want power and torque for the job. A bit of reserve is handy.

You'll notice that some makers put more money into shaft bearings (important to engine life) than others do. The same is true of mufflers (the bigger the better).

Oil-bath air cleaners are considered more effective than the dry type, but may be a nuisance on a rotary mower—the oil is likely to spill when you tip the mower for cleaning. Sears' top-of-the-line model has a self-cleaning dry type.

Cutting. A solid steel bar sharpened at the ends is practically standard. But a few makes (Jacobsen, Homko) have separate knives that can swivel back if they strike a rock. This helps protect the engine shaft—a part expensive to repair.

Close trimming at the side is very convenient because it lets you do a quick clean job along walks and fences. An ample range of cutting heights is good, too—you can mow lush spring grass close, dry summer grass high.

Body. Steel is the choice for strength. But aluminum is lighter, and can be as strong if it's thick enough. The size of the wheels, and the bearings in them, make a big difference in how hard you have to push. A staggered wheel arrangement helps keep the mower level on rough ground (some Lawn-Boy models add knee-action to one front wheel).

The mowers listed in the spec chart—they're the biggest-selling, nationally advertised brands—are only a few of the hundreds of makes on the market. Many of the others are just as good, and may be smart buys. Just be sure that the one you pick is a soundly designed, solidly built machine—and that you can get service for it. END

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Worlds of fun and excitement wrapped up in this sleek package—the leader in its field. Sturdily built for safety and service... modernly designed in two-tone colors for sharp appearance. The famous Cushman Husky 4-cycle engine delivers up to 50 miles per hour, up to 100 miles per gallon.

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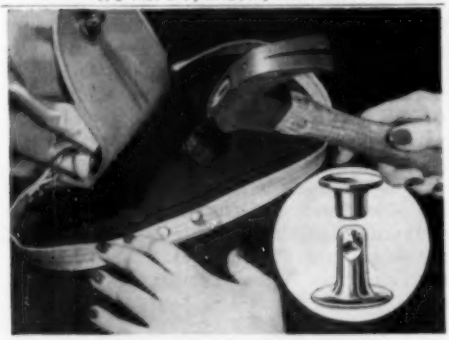

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Casite removes gum and goo—KEEPS the engine clean—increases power, improves performance, saves gas and repairs, too.

Results guaranteed, or double-your-money-back!

Get Casite at your service station, garage or accessory store.

HASTINGS MFG. CO., HASTINGS, MICH.
Piston Rings, Oil Filters, Spark Plugs

Tomorrow's Tires
[Continued from page 122]

the Michelin-X resists the usual tire's tendency to ripple and distort as it revolves. Michelin says this gives two to three times conventional-tire mileage. Few critics dispute the claim.

Most other claims made for or against the tire, though, are in dispute. European users are enthusiastic about its steering response, stability, skid resistance, low squeal, comfortable ride.

But American experts found that X-tires are too bouncy for their taste; while they absorb big bumps well, they fight little ones. It is said, too, that the wire-cord tires are hard to steer, have a tendency to wander, that their stability is uncertain. Because of their flatfootedness, they normally corner wonderfully well, but if they are pushed too hard on a curve they may skid out suddenly, without warning.

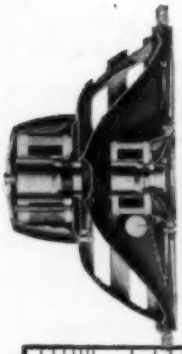
Which is right? Considering the differences between European and American car suspensions, both findings could be. Whether X-type tires can be matched to the softer-riding designs favored on this side of the Atlantic is a moot point. Several of the largest American companies have taken out licenses under Michelin patents. They insist, though, that their planning now stops at truck tires. The most optimistic estimates place wire-cord passenger tires four to five years away.

Meanwhile, tire researchers are looking about for other cord materials. Dacron and glass fibers, potentially, could increase body strength. But at present one has poor heat resistance and the other low flex life.

Laboratories are also trying to improve nylon and rayon cords. The main object is to obtain a higher ratio of strength to bulk in the interests of cooler-running tires.

This is all part of a growing concern for high-speed safety and is related to a potentially ominous fact: Most cars can now run faster than their tires—and too many of them do.

Tire failure at high speed takes several forms, all dangerous. Standing waves cause distortions in the tread and body that can make a tire wobble violently and throw a car out of control. Centrifugal force may tear off the tread. Or heat



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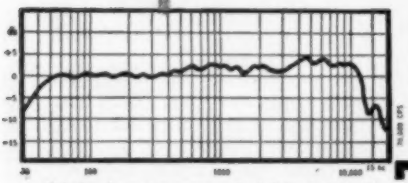
General Electric 12" Golden Coax

Model A1-401



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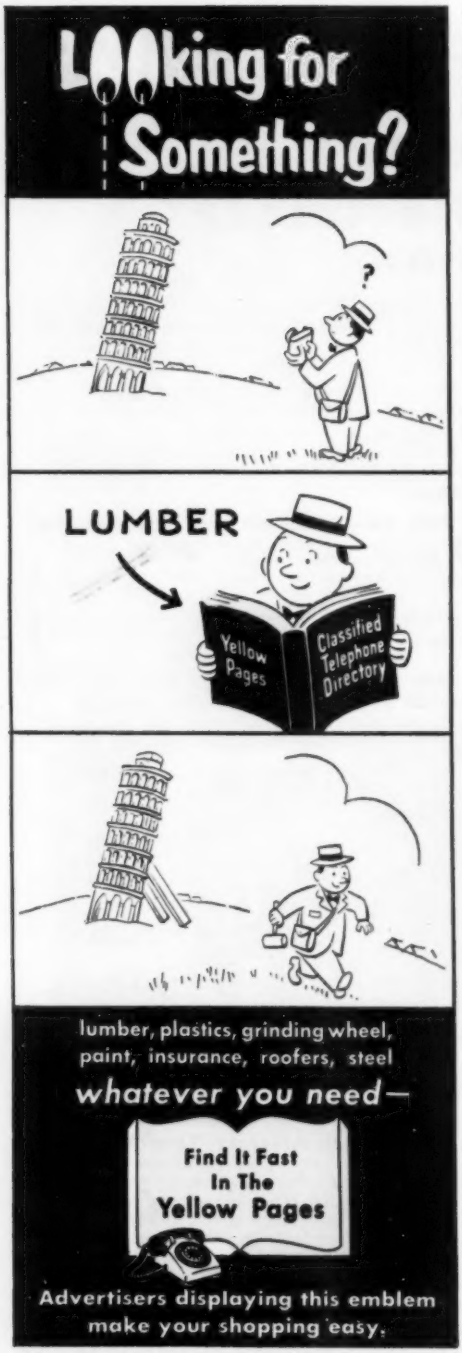
You can see Hide-A-Shelf and Turn-A-Shelf working models at your AMEROCK hardware dealer or lumber dealer.

Recommended for use in Home Improvement Council Remodeling Contest

Write name and address below, send to AMEROCK Corp., Box PS84, Rockford, Illinois



and pressure may separate the plies, especially in tubeless tires that give hot air less chance of escape.

Because these and other forms of tire failure have been increasing (particularly in the South and Midwest), rubber companies have started to build special "high-speed tires." By this summer, all major producers and probably some smaller ones will be marketing premium lines designed for speeds in excess of 130 m.p.h.

And a definite swing to nylon cords in run-of-the-mill tires can also be foreseen. Some tire men predict that nylon will be used exclusively within two years, though this may reflect more wishful thinking than actual belief.

Rubber companies would naturally like such a development because it would simplify production and inventory while favoring their more expensive lines. But technicians also insist that nylon's strength—and the strange fact that it shrinks when hot—makes it a safer tire fabric for the speed and temperature conditions that are becoming commonplace.

Nylon's main stopper is that it does more for a tire than it does for a car. It's noisier than rayon and squeals more on curves and, because of a tendency to "grow," tires wear faster. Nylon tires also take a "set"—that is, develop small flat spots when left standing. Though these spots quickly run themselves out, car makers have so far refused to demonstrate their new models on tires that thump noisily for a couple of miles.

Some experts think nylon's weaknesses can be overcome, while others feel that stronger rayon cords—plus better rubber adhesives—hold out a brighter hope. But whatever the future brings, there's little chance that the maximum of safety, comfort, style, economy, and sales appeal can ever be combined in a single tire.

Yet while compromise is inevitable, some new materials and designs may make possible a different kind of compromise in which advances along one front do not result in retreats along another. Lab men are confident that tomorrow's tires will overcome recent losses in tread life while holding—or even making some gains in—riding comfort.

But above all, future tires must be made safer for the turnpike speeds we'll all be hitting in the years ahead. END

Faster, safer way to wash your car

Du Pont Car Wash gets your car so clean it drains dry, without *wiping*. Unlike ordinary detergents, it's safe for wax and it doesn't streak! At service stations and auto supply stores—½-lb. can only 75¢.

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. . . THROUGH CHEMISTRY

DU PONT CAR WASH

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Don't spoil a repaint job by painting over a cracked or peeling finish. It's so easy to remove it with Wonder-Paste.

This famous remover is *different!* Finish comes off in one easy scraping—not coat by coat.

Quickly applied with a paint brush. Does not run on upright surfaces. Remains moist and active, even outdoors.

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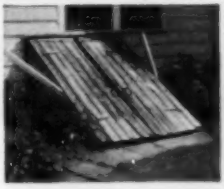

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MILLERS FALLS CO., Dept. PS-24, Greenfield, Mass.

Driving an Auto-Pilot Car

[*Continued from page 107*]

Pilot turned on than with it off. The reason appears to be this:

Suppose you are traveling on a main Louisiana or Texas highway, with little or no traffic. You find, operating the accelerator by foot, that you stabilize at about 65 m.p.h. indicated as your preferred fast cruising speed. Watch closely, though, and you'll see that that speed is not quite uniform, and that the variations are intentional. Depending on what can be seen a half-mile ahead, on road surface, side winds, vibration, grades and many other factors, you modulate that preferred fast cruising speed over a range of perhaps four or five miles an hour. You drive, in other words, about as fast as you think proper under the circumstances—and the circumstances keep subtly changing.

Now suppose you latch the robot at 65 m.p.h. on the same road. In the circumstances where it's the right speed or just a little slow, you don't mind. In those where it's just a little fast, you soon become vaguely uneasy. So you reach forward and twist the knob back a little.

On our trip, automatic running was consistently a little slower than conventional running. This reduction seems all to the good: It pays dividends in relaxation and improved gas mileage, and, being held with machinelike steadiness, doesn't depress average speeds.

Passing and night driving. These are, of course, the most technically demanding parts of highway travel. As might be expected, you usually want no part of the robot during a high-speed pass; it's simply not suited to those critical moments when you hang behind a car or truck, stealing glances and calculating whether or not you have a passing chance. In all our 4,000 miles we made only three automatic-control passes, each with miles-long visibility.

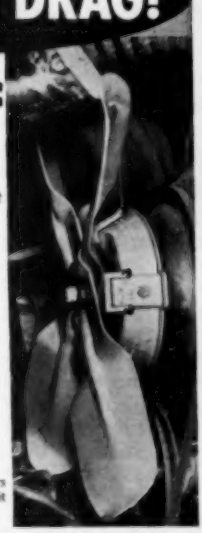
At night on narrow roads the Auto-Pilot also has limitations. Partly this is because your reading of what is at the far fringes of the high beam is shaky and fast-changing. And partly it is because your right foot hankers to modulate speed as headlights come toward you. (Notice what that foot does the next time you meet High-beam Harry on an 18-foot highway.) But both the passing and nighttime limitations disappear on di-

Driving an Auto-Pilot Car

STOP FAN DRAG!

with the NEW
FAN-O-MATIC
MODEL 200
Automatic FAN RELEASE

*Makes fan a free-wheeling unit at speeds over 35 MPH**



INCREASES

- **Available Horsepower** up to 20 H.P. at cruising speeds.
- **Gas Mileage** up to 3 miles per gallon . . . by actual road tests.
- **Acceleration** up to 10% . . . in official tests conducted at Indianapolis Speedway by U. S. Auto Club.

REDUCES

- **Engine Noise, Vibration** for smoother, quieter riding.

Simple to install. Adaptable to most cars
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**Easily adjustable to higher or lower speeds*

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pull the trigger...
spray paint
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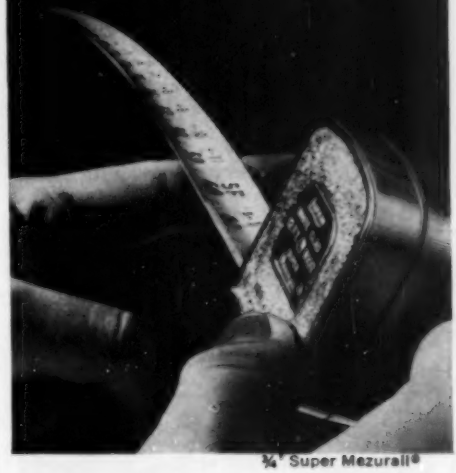
FIVE FEET OUT
but the LUFKIN doesn't buckle



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Do it, and you'll join the "pros" who insist on Lufkin quality—yet you'll pay no more for it. Because Lufkin is *the* quality tape rule at a popular price.

You'll find dozens of uses for it in your house and workshop. Look for the yellow and green box at your hardware store.

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TAPES • RULES • PRECISION TOOLS

Special

TRADE-IN OFFER

Now get

$1.00

trade-in allowance for your old torch* toward this modern

BERNZ O MATIC®

All-purpose

PROPANE TORCH KIT

Regular retail price.....$8.88
LESS YOUR TRADE-IN... 1.00

now you pay only $7.88

*Any old torch—Gasoline, Butane, Kerosene, "Tin-Can" Type, Alcohol, Propane—regardless of age or condition.

Here's the kit you'll use hundreds of times—for home and auto repairs, thawing frozen pipes, hobbies, starting charcoal fires, laying asphalt tile, electrical work etc. Torch lights with flick of a match. Burns clean without soot. Plenty of heat. Up to 2300°F! Safe, disposable fuel cylinder.

NO OLD TORCH?

YOU can still get a $1.00 allowance if you clip this ad and bring it to your local dealer. He'll give you this $8.88 all-purpose torch kit for only $7.88!

(See pages 58-59 H.I.C. $125,000 Contest)

Otto Bernz Co., Inc., Rochester, N. Y.

vided highways, especially limited-access ones. Here, if traffic is not too heavy and the weather is good, you are usually eager to let the robot do its job.

Is it really safe? The answer isn't simple, for there are at least three separate factors involved:

1. It certainly promotes safety by reducing fatigue. At the end of a 600-mile day you are noticeably fresher than you would be with a conventional accelerator. This is not solely because you are spared the leg cramps and stiffness that come from having your right leg constantly committed. It is also because you simply have less work to do.

2. Its design is moderately but not absolutely "fail-safe." A sticking contact could theoretically open the throttle. This wouldn't necessarily mean disaster, short of shifting to neutral, for the brake switch could still kill the latching circuit. But it would certainly startle and alarm you.

3. It does not invite highway hypnosis. The explanation for this lies in your past driving experience. You lend the Auto-Pilot a duty you have been trained to perform yourself, and this somehow makes you just a little uneasy. It is not an entirely relaxing thing to sit back at 70 m.p.h. and feel the engine get gas from some other agency than yourself; your alertness is more likely to be heightened than lulled. This slight wariness stays with you as long as the device is working, even after thousands of miles have been logged.

Does it make sense? For intercity driving, turnpike travel, and long trips generally, the Auto-Pilot is a genuine help. On curvy or mountain roads, downtown, or in heavy traffic anywhere, you will find less use for it. (Though still some: The speed-minder function is handy anywhere, and could save you some speeding tickets.)

That, then, is the little robot: busy, often precise, sometimes a little stupid, and very useful.—*Frank Rowsome Jr.*

Next Month: The lowdown on tune-ups —how to tell when your car needs one, what to expect when you get one. See May PS for the answers to all your questions, in "What Is a Tune-Up?"

TV's New Trick: Hidden Commercials

[Continued from page 97]

WAR SURPLUS BARGAINS SAVE UP TO 90%

FAMOUS NAVY MK14 AIR COMPRESSOR
Great for tree, termite, airbrush & paint spraying; filling tires, aquariums, etc. Dual & remote control electric receptacles, 115v 60 cycle AC, heavy duty HP. Westinghouse Motor. Direct drive. Water & explosion-proof. Built-in air filter, adjustable pressure setting up to 47 lbs. Built-in pressure gauge. Self-contained switch. Mounting brackets. These units made under license of Sperry Gyroscope Co. Wt. 66 lbs. gross. Approx. GOVT. COST $585. Like NEW. **$21.95.**
With portable steel hand cart (shown), rubber wheels, specially constructed for mounting this unit. Incl. 25' rubber air hose. 6' extension cord with plug & fittings. Wt. 76 lbs. Complete with cart—**$26.95.**
With new internal-pressure spray gun with 3 adjustable spray tips, 1 qt. cap. **$35.95** complete.

ARC WELDER KIT—$26.00 Build your own complete make-up package incl. 1 Aircraft DC Gen. 200 Amps. 24 V; Rheostat, Toggle Switch, 1 Ammeter, Electrode Holder, Welder's Shield, Voltage Reg. Simple instruction wiring diagram. Wt. under 100 lbs. Approx. GOVT. COST $475. Like new, perfect. All units guaranteed pre-tested. **$26.**

BUILD YOUR OWN ARC WELDER, LIGHT PLANT OR BATTERY CHARGER $37.50
Kit incl. 1 Navy NEA-5 Gen. combination AC-DC type. AC 115 V. DC 24 V., 200-300 Amps. 2 complete generators in 1, yet no larger than reg. gen. Ideal for home, shop and farm lighting plants. Delivers 1200 Watts AC, DC side for charging batteries, welding and operating war surplus motors. Also in kit: 2 Voltage Regs., AC & DC, Reverse Current Relay, 1 Ammeter, Rheostat, Electrode Holder, Toggle Switch, Welder's Shield, Wiring Diagram for kit. Wt. under 100 lbs. Approx. GOVT. COST $650. Kit—**$37.50.** Navy NEA-5 Gen. as above, purchased separately. **$23.50.**

R1 GENERATOR KIT Jack & Heinz or GE. Rated 300 Amps. 24-32 V. With same items as above. Approx. GOVT. COST $600. Complete 80 lb. kit—**$36.**

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HEAVY-DUTY RHEOSTAT Ideal for regulating voltage on electric welders. Rated 5.75 Ohms, 100 Watts with double windings & dual female 25 amp., 125 V. receptacles. 7" hi x 3¼" D. Shpg. wt. 2½ lbs. Approx. GOVT. COST $25. Brand New. **$2.25** ppd.

MICROMETERS Black crackle finish frame. Easy-to-read graduations in .001. Mfd. 0-1" cap. **$2.89** ppd. 1-2" cap. **$3.79** ppd.

EXPLOSIVE RIVET & BLOW TORCH KIT
Contains 300 assorted Dupont Explosive Rivets, 1 set of 9 fractional drills, 1 Butane Blow Torch with extra cartridge—everything needed for blind riveting. Torch can also be used for precision soldering, brazing, etc. 3500° pinpoint flame. Approx. GOVT. COST on rivets alone, $90. Complete kit **$5.95** ppd.

DUPONT EXPLOSIVE RIVETS Essential wherever blind riveting required. 1/8", 5/32", 3/16". Round & flat heads. Approx. GOVT. COST 32c ea. 1,000 assorted for only **$9.00** ppd.

ELECTRIC PUMP WITH CONTROL UNIT
Runs on 12 or 24 V. Centrifugal type. Pumps 500 GPH. Complete with on and off switch rheostat, 2 speeds (hi & lo). Mfd. by Ingersoll-Rand. Shpg. Wt. 7 lbs. Approx. GOVT. COST $195. NEW. **$8.95.**

CHRONOMETRIC TACHOMETER Built to U.S. Navy & Air Force specs. Standard brand. For counting revolutions per min. for any rotating shaft. Can be used on speeds up to 10,000 RPM. Accuracy to 1/10 of 1%. Complete with male & female tips & shock-proof case. GOVT. COST $87.50. NEW. Only **$19.95** ppd.

140-1 REDUCTION GEAR For beaching boats, winches, hoists. Ideal for motor in golf or boy's electric car. Built-in (removable) DC motor & clutch. Hi torque, 1s speed. Runs on 6-12 or 24 V. Wt. 65 lbs. gross. Approximate GOVT. COST $300. Like NEW, **$12.00.** Matched splined gear for above—**$2.00** ea.
*225-1 REDUCTION GEAR—**$13.50.**

WOOD PROPELLER Genuine rock maple radio drone "prop," perfect for den, trophy room, boy's room. Smooth, highly varnished, 30" tip to tip. Clock, barometer or photo can be inserted easily into center (mounting holes provided). Can use to operate ice sleds, etc. Approx. GOVT. COST $57. NEW. **$4.95** ppd.

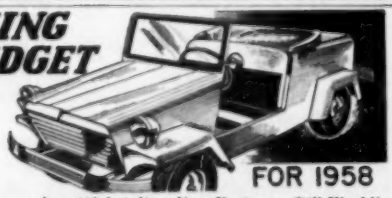
B-16 KOLLSMAN AIRCRAFT COMPASS Ideal for boats, cars, etc. Grad. in 5° increments. Liquid-filled. Lighted. Poly-plane compensator. Panel mounting. 3½" dia. face; 4½" deep. Checked & tested in our own lab. Approx. GOVT. COST $150. Like NEW. **$12.95** ppd.

ASTRO COMPASS MARK II Used by USAF & commercial airlines. Makes pelorus & azimuth circle for air or marine navigators. Great for astronomers. Incl. carrying case. Tested for accuracy in our own lab. Approx. GOVT. COST $400. Now **$10.95.**

NEW! TERRIFIC! 1958 CATALOG! Thousands of bargains in war surplus & other items. Hundreds of pictures. Send 25c for your copy today! Ppd. prices in USA only. Other prices FOB Culver City, Calif. Send cash, check or money order. 50% deposit on COD.

AIRBORNE SALES CO., INC. DEPT. PS458
8501 Stellar Drive Culver City Calif.

KING MIDGET



FOR 1958

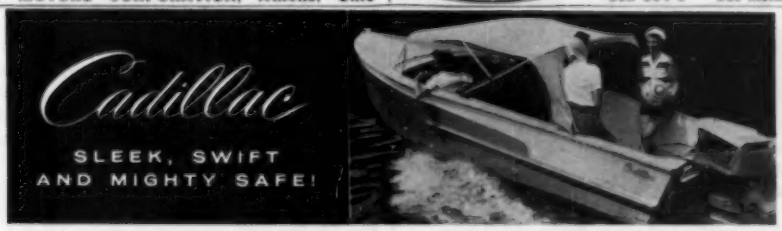
More power, beautiful styling. New Features. Still World's Lowest Priced Car. Drive it for 75c a week. Rider agents wanted. Earn your own car. If no dealer near you send 25c for 32 page picture book with full details and dealer price. Or send $1 (refunded first order) for this and Service Manual, plus Repair Manual, plus 15 5x7 photos of car and factory.

MIDGET MOTORS CORPORATION, Athens, Ohio

The Modern PLASTIC for lasting Home Repairs

PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. The big 4-lb. can is obtainable from your lumber, paint or hardware dealer at $1.40; or will be shipped direct postpaid (in U. S.) for $1.75. Complete satisfaction guaranteed or your money refunded. Order now.

DONALD DURHAM CO.
Box 804-U Des Moines, Iowa

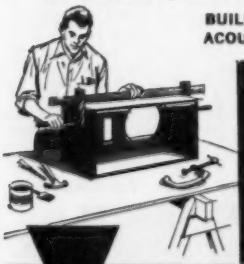


More fun on the water, less work out of water — that's the Cadillac story for '58. Plenty of room for friends and fishing gear. Light but mighty seaworthy. The perfect answer to *all-'round* water fun. H.P. ratings up to 75. Write for free folder on Cadillac aluminum, molded plywood and ply-lap* models.

*Pat. Pend.

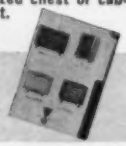
CADILLAC MARINE & BOAT COMPANY • Cadillac, Michigan

Start with a JBL D130—your basic loudspeaker. In no other high fidelity component is precision more important. The D130 is an unquestioned masterpiece of precision, without equal in advanced engineering, meticulous craftsmanship, and accurate reproduction. The JBL D130 is the only 15" extended range loudspeaker made with a 4" voice coil. When the D130 is used alone, this makes for crisp, clean bass; smooth, extended highs. Later, when you advance to the ultimate excellence of a JBL two-way system, add a JBL high frequency unit and dividing network. Then your JBL D130 will serve as a perfectly matched, beautifully balanced low frequency driver.



BUILD YOUR OWN ACOUSTICAL ENCLOSURE

An engineered, solidly built acoustical enclosure is required for satisfactory bass reproduction. You can build your own for your D130 . . . build it to stand alone, build it into a wall or closet, or to fit inside some prized chest or cabinet.



Send for this free booklet which tells how to build a bass reflex enclosure of the size you require.

JBL

JAMES B. LANSING SOUND, INC.
3249 Casitas Ave., Los Angeles 39, Calif.

Send free Reflex Construction Folder and Catalog.

NAME_____

ADDRESS_____

CITY_____ZONE_____STATE_____

TV's New Trick: Hidden Commercials

[Continued from page 97]

and a square—were used. In the other, gasoline trade names were used.

After the audiences had seen the films, they were asked to tell whether they liked, felt indifferent to, or disliked each movie. They were then shown the symbols and the trade names and asked to give their reactions to them. The results suggested that the way people had reacted to the symbols and trade names influenced the way they reacted to the movies. If they felt "positive" toward the preconscious information, they liked the movie; if they felt "negative" about the information, they objected to the movie.

The Precon inventors feel this point, then, is amply proved: Our preconscious likes and dislikes are the same as our conscious ones. Nobody, they contend, is going to convince us by Precon TV to buy something we don't want to buy, or do something we don't want to do.

Corrigan and Becker began their experiments with Precon apparatus with the thought that the technique would be wonderfully useful in education (training films) and psychotherapy (reaching the consciously withdrawn patient by tapping him on the subconscious). They still are ardently convinced of this.

The commercial possibilities occurred to them later. Already the inventors, through the newly created Precon Process & Equipment Corp. of New Orleans, have marketed a counter-top or window-display electrical device for flashing Precon advertising at passersby who think they are merely looking at an attractive illuminated color photograph. There is a strong likelihood that there'll be Precon movies, too.

Dr. Corrigan is convinced that if emotion-charged words suitable to the action of a movie are included in the film but are not consciously visible to its audience, the movie will gain in impact. Prof. Becker says the trick can be turned by superimposing the words on a master print of the film, but that a better way would be to synchronize a special Precon movie projector with each theater projector. A leading motion-picture studio has indicated seriously that it would like to be shown how a Precon movie could be made. And a wag has already suggested what to call it—a "feelie." END

TOP VALUE SPECIALS!

Our 5,000-Mile Missile Is Ready Now

[Continued from page 114]

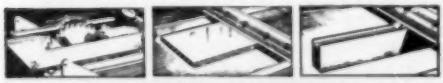
Wash off old paint with water!

Amazing how easy it is to use this miracle new WASH-AWAY Paint Remover. Just brush it on . . . wait a few minutes . . . wash off with water — your surface is clean, ready to refinish. Ideal for removing old finish from delicate antiques. Fine for outside use . . . siding, shutters, porches, boats. No scraping! Nonflammable!

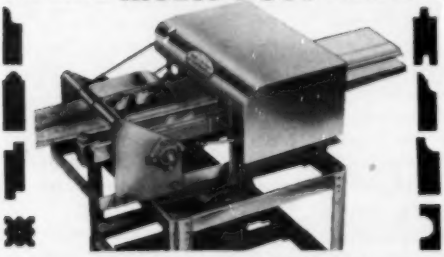
AT SHERWIN-WILLIAMS DEALERS EVERYWHERE!

listed in yellow pages of phone directories

SAWS **PLANES** **MOLDS**



NEW BELSAW MULTI-DUTY POWER TOOL



Now you can use this ONE **power-feed** shop to turn rough lumber into high-value moldings, trim, flooring, furniture . . . ALL popular patterns.

RIP . . . PLANE . . . MOLD . . .

separately or all at once by **power-feed** . . . with a one horsepower motor. Use 3 to 5 HP for high speed commercial output.

FULLY SAFE-GUARDED, anti-kickback design.

Low Cost . . . You can own this money-making power tool for only $30.00 down payment.

Write TODAY for free Catalog

BELSAW POWER TOOLS • 928 Field Bldg., Kansas City 11, Mo.

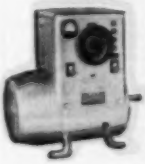
arc welding Pays Big MONEY!

Cash In

on the big demand for arc welding

200 Ampere "HUSKY BOY"

AC Transformer Shop Type Welder



AC Welder AC Power Combination

Every day more and more opportunities for big profits arise in arc welding. Why not cash in, especially when it's so easy to do—with a low cost, high efficiency Hobart welder. Any one of these easy-to-use models puts you in business immediately.

200 amp. "HUSKY BOY" welds anywhere. Light, rugged, compact—easily mounts on your tractor or trailer to go to those emergency repair jobs. Portable mountings also available.

AC TRANSFORMER is a popular model for small shops, auto service shops, plumbing and heating contractors, farm welding, etc. Economical to operate, yet has big industrial model features.

AC WELDER/AC POWER 200 amp. combination furnishes current for welding and power for running tools, lights, etc. Simply connect it to your own power source or to portable gas engine.

WELDING LESSONS BOOK, 200 pages, fully illustrated. Self teaching, **$1.00**

HOBART BROS. CO., BOX P-48, TROY, OHIO, FE. 2-1223

"One of the world's largest builders of arc welding equipment"

"BUILD-YOUR-OWN" GAS DRIVE WELDER

Save $200 to $300 using this Hobart DC Welding Generator that gives you the opportunity to build your own efficient portable gasoline driven arc welder, at low cost.

These generators come equipped with all the features that are standard with Hobart factory-built engine driven models. Write for free booklet—"How To Build Your Own Arc Welder."

Some typical home-built welders

HOBART BROTHERS CO., Box P-48, TROY, OHIO, U.S.A.

Please rush me complete information on:

- ☐ "Husky Boy"
- ☐ AC Welder/AC Power
- ☐ AC Transformer
- ☐ Build-Your-Own
- ☐ Send Welding Lessons Book. I enclose $1.00.
- ☐ Booklet—"How To Build Your Own Arc Welder"

Name_____

Address_____

City_____ State_____

SPRAY | EASIER QUICKER

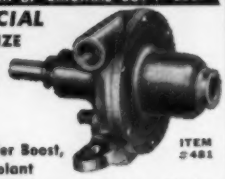
TOP VALUE SPECIALS!

SURPLUS ITEMS AT FRACTION OF ORIGINAL GOV'T. COST

OUR SPRING SPECIAL

OBERDORFER BRONZE

CENTRIFUGAL PUMP



ITEM #481

For: Fluid Transfer, Sprinkler Boost, Circulating, Marine Coolant

Designed for continuous, heavy service. Carbon bearings require no lubrication. For direct or belt-drive with speeds up to 3450 RPM. All bronze housing and impeller with ⅛" stainless steel shaft. Has ¾" inlet and outlet.

With ¼ H.P. Motor delivers—Gallons Per Minute, Head in Feet

R.P.M.	0	4	6	8	12	16	20
@ 1750	3.00	2.00	1.25				
@ 3450	7.25	6.75	6.50	6.25	6.00	5.25	4.25

Regularly $26.50 **OUR SPECIAL SPRING OFFER, ONLY** **12.50** Ppd. 2 for 23.00

1½ H.P. HYDRAULIC SPEED REDUCER with FINGERTIP CONTROL

USE FOR: • Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

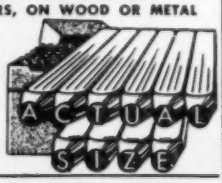
Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of ¼ to 1½ H.P. Shafts ⅝" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7½"x7½"x11½". Output rotation reversible. Shipg. wt. 81 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... **72.50**

Item # 115

37-PIECE METAL STAMPING SET

STAMPS NAMES, NUMBERS, ON WOOD OR METAL

ITEM #390-B—FULL ALPHABET, A-Z, NUMBERS 1-0, "&", AND PERIOD. PRECISION HAND TRIMMED, deep cut, hardened TOOL STEEL STAMPS—IN FITTED EASY ACCESS CARTON. Made to rigid U.S. Army specifications.



Only $5.50 per Set

2 for $10.00 Ppd.

1 H.P. 12 VOLT ELECTRIC MOTOR

ITEM #308 — • For electric wheel chairs (Pop. Mech. design—Mar. 1953).
• For electric golf carts.
• For self-propelled scooters, children's midget cars.

Rated 1 H.P.—100 amps., 5600 R.P.M., 12 volts, D.C.—This double shaft motor of ball-bearing construction may be run on 6 volts for lower horsepower requirements—Standard ⅝" shafts, flange mountings.—Dimensions: 9" x4½"x4½". Ship wt. 19 lbs. A real value at **12.50** F.O.B. Chicago

2 H. P. ELECTRIC MOTOR

ITEM #315—24 Volts, 90 Amps., 4000 RPM, Spline shaft both ends. Style similar to above. Mfgd. by Hobart or Diehl, F.O.B. Chicago..... **13.00**

FREE! NEW SUMMER 1958 CATALOG

60 VALUE-PACKED PAGES of unsurpassed War Surplus and newly manufactured Equipment. Bargains for farm, home, factory, workshop. Write letter today.

Order Direct from Ad. Send Payment Or Purchase Order Today
For Phone Orders Call WEbster 9-3793

GROBAN SUPPLY CO. Dept PS-4
1139 S. WABASH AVE., CHICAGO 5, ILL.

Our 5,000-Mile Missile Is Ready Now

[*Continued from page 114*]

In many a test flight out over the dark blue sea southeast of Florida, a Snark's guidance system has steered the missile around a rectangular course covering a couple of thousand miles, and brought it back to its base. There, with the aid of parabrakes and special belly and wingtip skids, it was safely landed by radio command, ready for more tests.

This is the way some military analysts see the Snark's strategic role:

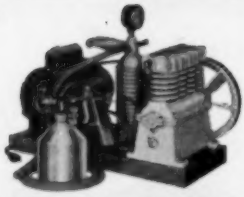
- With their enormous range, Snarks could reach all potential enemy targets from bases entirely within U. S. territory. Furthermore, those bases could be rapidly shifted. In contrast, IRBM bases must be located mostly in foreign countries, where they will be vulnerable to political hazards; and can't be moved.
- In the event of a surprise enemy strike at fixed U. S. air and missile bases, Snarks could launch a retaliatory attack within minutes from bases whose positions could never be precisely known to the enemy, since they can be quickly and repeatedly changed.
- The Snark's guidance system is so accurate that it can be depended on to steer the missiles to so-called "hard" targets (dams, railroad yards, factories) as well as "soft" ones (sprawling air and naval bases, large cities).
- Enemy defense against Snarks would be both very difficult and costly.
- A mass attack of Snarks would be a most effective prelude to an attack by our long-range manned bombers. The Snarks could carry hydrogen warheads triggered to explode at ground level, so that even if the missiles were knocked out in the air, the bombs would not explode till they hit the earth, where they would do devastating damage.

Such an attack could be launched with no loss to our Air Force personnel; and at a cost approximately 1/30 as high as that of an attack by a comparable number of manned heavy bombers, fueled by a fleet of aerial tankers, which Snarks don't require.

Then, if the Snarks were to be followed by waves of B-52s, the men in those big bombers would have the advantage that the enemy ahead had already been badly battered, and there were great holes in his defenses. **END**

SPRAY

Professional results everytime with PRESSURE QUEEN the only 4 cyl. portable air compressor



PAINT

Non-pulsating, continuous air flow for fine finishes... spraying house or barn... fast... easy... sprays paint undiluted, 4-5 times faster than brush—better too!

Write for details and name of your nearest dealer.

The Campbell-Hausfeld Co.
151 Railroad Ave., Harrison, Ohio

CAMPBELL-HAUSFELD

WELD **BRAZE** **SOLDER** **CUT**

4 WAY WELDER

ONLY **$14.75** f.o.b. factory

Complete with Twin Carbon Arc Torch and accessories . . . to handle all metal-craft work.

Acclaimed by thousands of Homeowners, Mechanics and Hobbyists as the welder of 1001 uses. Easily operated from properly wired 110 volt AC or DC line. **The ideal gift with a life-long use . . .** Order today on 10 day money back guarantee.

FOUR-WAY WELDER CO., Dept. F3-D
1810 S. Federal St. • Chicago 16, Ill.

Sharpen YOUR SAWS with QUICK-WAY

Now you can sharpen, joint, gum and retooth all circular saws to 12" dia. Precision results. Safety Guide, Mounting Block, and Grinding Wheel included. Model PG-12 $19.95 Postage Paid. Send for Circular FREE! Special Saw Set with each QUICK-WAY unit purchased: ($2.75 if ordered separately).

QUICK-WAY SAW CO. 234 Tompkins St. Cortland N. Y.

BUY DIRECT • SAVE ON • TILLERS • TRACTORS

5-6-7-9 H.P. 2 wheel &

4 wheel tractors

Full line of attachments for mowing, gardening, farming 2-3-4 H.P. TILLERS 12"-16" CUT

FREE CATALOG & PRICE LIST

RED-E TRACTOR CO.
RICHFIELD 4—16th ST., WIS.

ONE BIT FOR ALL

.... DRILL SAW • REAM CUT

Handiest drill bit made. Use on any electric drill, lathe, drill press, etc. Made of finest American hi-speed steel. 3½" long, ¼" diameter. Has 2" side-cutting section. Cuts steel, wood, plastic, aluminum, etc. 3 types—specify types wanted. (1) All purpose, (2) Wood, (3) Heavy metal. *$2.45 each — 3 for $7.00 — Postpaid.* Money back guaranteed. Buy from your dealer or send check or Money Order and name of favorite tool dealer TODAY. (Makes ideal gift.)

BEAVER Hi-SPEED-SAW DRILL BITS

Jobber & Dealer Inquiries Invited

BEAVER DRILL & TOOL CO., 3008-A McGee Trafficway, Kansas City, Mo.

EASIER, QUICKER BAND ADJUSTING

with Proto professional tools

Proto's simplified set makes factory recommended band adjustments on all automatic transmissions with fewer tools . less cost

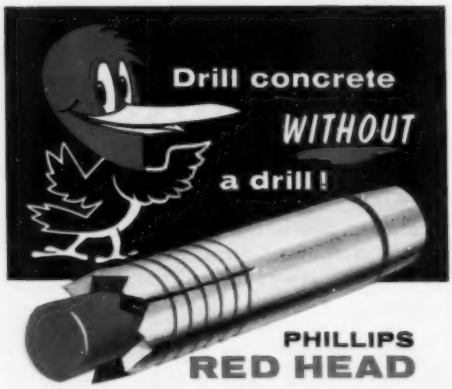
PART NO.		DESCRIPTION
1.	9973	Partitioned Metal Box (10-11/16"x8"x1½")
2.	2356	Wrench—open end (⅝")
3.	6061F	Torque Wrench (¼" drive)
4.	2357	Band Adjuster
5.	4742	Allen Hex Socket (¼" hex, ¼" drive)
6.	4710S	Socket—8 point (5/16" op., ¼" drive)
7.	4710	Socket—6 point (5/16" op., ¼" drive)
8.	4743	Screwdriver bit (⅜" bit, ¼" drive)
9.	5324	Socket—12 point (¾" op., ½" drive)
10.	5322	Socket—12 point (11/16" op., ½" drive)
11.	2359	Handle and gage (¼" drive, ¼" gage)
12.	2354	Servo Gage—Front
13.	2355	Servo Gage—Rear
14.	2360	Manual
15.	2361	Chart

ANOTHER REASON YOU'LL **PREFER PROTO** PROFESSIONAL TOOLS

Precision band adjustments easy and profitable for any mechanic. Fully illustrated Manual #2360 shows you how. Chart #2361 gives factory specifications. Both included in this great, new Proto Set #2350. Write Proto for details **DEPT. A.T.**

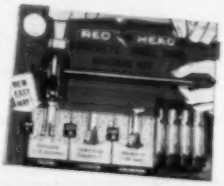
PROTO TOOLS
PROTO means PROfessional TOols
DIVISION OF TOOL INDUSTRIES INC.

2212 Santa Fe Avenue, Los Angeles, Calif. • 583 Allen Street, Jamestown, N.Y. • P. O. Box 366, London, Ontario, Canada



A *concrete anchor that cuts its own hole,* then expands to become threaded anchor for any standard ¼" bolt. Holds hundreds of pounds. Can't come out. Install by hand in 2 minutes or with impact hammer in 22 seconds.

HOME DRILL AND ANCHOR KIT $1.85



Driver and 4 Red Heads. $2.00 (postpaid) by mail if your dealer cannot supply you.

PHILLIPS DRILL CO.
Dept. H-8804
Michigan City, Indiana

NEW FIR PLYWOOD

BOAT PLANS

25¢ ea.

★ Designed by leading naval architects for style and top performance

★ Specially planned for "do-it-yourself" construction with fir plywood

Large, easy-to-follow scale plans have step-by-step illustrated instructions and complete material lists

OUTBOARDS

11' (Plan 35)—Fast, roomy car-top utility model.

13' (Plan 40)—Ideal for skiing and fishing or family fun.

16' (Plan 55)—Roomy deluxe runabout. Seats 6 in comfort.

CABIN CRUISERS

18' (Plan 60)—Easy-to-build family day cruiser.

20' (Plan 65)—Sleeps 2. Has galley, head.

ROWBOATS

8' (Plan 30)—Light, all-purpose pram. Takes small outboard.

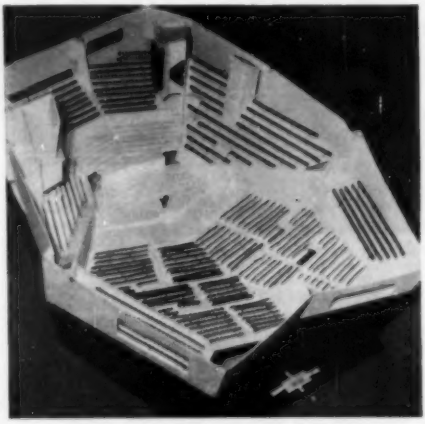
14' (Plan 45)—Roomy, flat bottom punt for hunting and fishing.

PLANS 25¢ EACH. Order by number. Also write for free folder describing boats in detail. (Offer good USA only). Douglas Fir Plywood Association, Dept. 11, Tacoma, Washington.

Use only Exterior plywood (EXT-DFPA®) for boats. Comes in several sizes, grades—including premium quality solid-core "Marine Exterior" for hull construction.

Spot welder handles big jobs

BIGGEST resistance spot welder, this Federal giant is 13½ feet high, weighs 29 tons. It puts out 100,000 amps to stitch together jet-airliner tail sections in a throat that takes 2,100-square-inch work.



New hall puts music in center

BACH and Beethoven will soon resound in a concert hall built like a Greek amphitheater. The model, designed for the West Berlin Philharmonic Society, puts the performers in a central arena and the audience in tiered seats around them.

ACCEPT NO IMITATIONS — BE SURE IT'S A

KING O'LAWN

KING O'LAWN
18" Homeowner
Model Shown

$149.50

F.O.B. South Gate
California

Total weight of
power mower
115 lbs.

1958 Model Briggs Stratton
lightweight 4-cycle
engines used.

Dual Automotive
Clutch Control

Mows within ⅝"
of wall, tree, etc.

All chain drive

This mower will
give your lawn that
golf-green carpet look.

That *Forward* Throw
All cuttings are
delivered forward.

KING O'LAWN
Junior model
power edger
trimmer shown.

For edging and
trimming along
sidewalks, curbings
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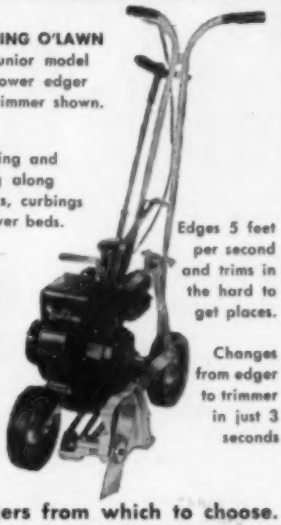

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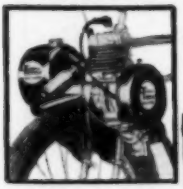

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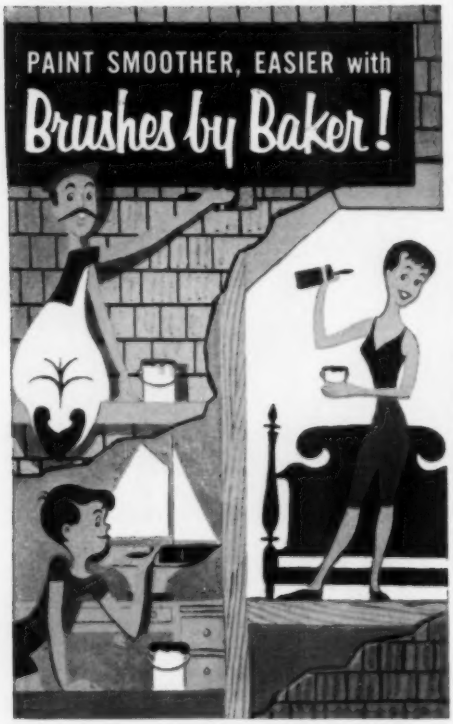

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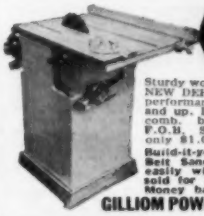

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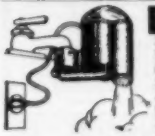

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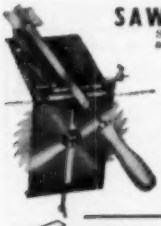

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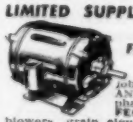

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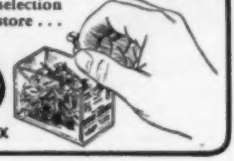

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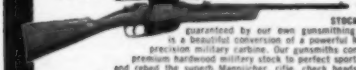

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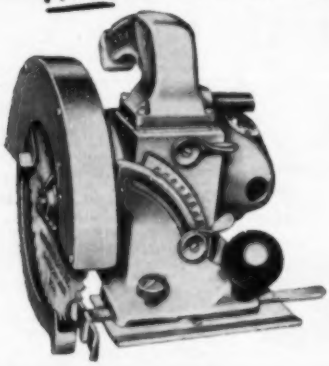

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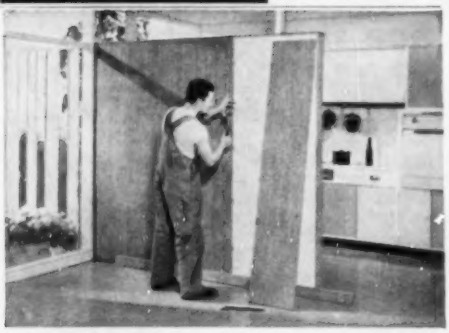

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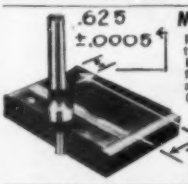

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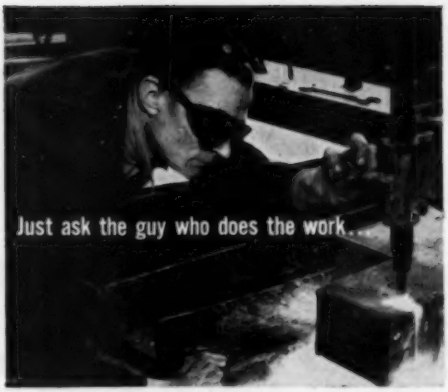

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What We Know About the Moon—So Far

[*Continued from page 94*]

...tion, since a 150-pound man weighs only

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This complete rolling cabinet is ruggedly built of heavy formed and welded steel for permanent service on the job or in your home workshop. Three top drawers are cork-lined for precision tools—two heavy duty bottom drawers are extra deep for power tools. Complete with built-in lock.

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[Continued from page 94]

detection by such tests. Even so slight a trace—which does exist, recent optical experiments suggest—would have tremendous consequences.

Imaginative accounts have pictured lunar explorers bombarded with death-dealing meteorites, and forced to take underground shelter. But a trace of atmosphere would suffice to form a "meteor screen" and burn up most meteors before they reached ground, as on earth. The rarity of observed flashes tends to confirm that this is just what happens.

Powerful ultraviolet rays of sunlight, another hazard anticipated for spacemen on the moon, may likewise be filtered out by a lunar atmosphere. But still it must be so rarefied and devoid of oxygen as to be useless for breathing; explorers must bring oxygen along.

Space suits and above-ground living quarters must be insulated against violent extremes of heat and cold—the moon's surface temperature soars to 214 degrees when the sun is overhead, and plummets to 250 degrees below zero at night. Enduring such rigors may seem inconceivable to an earthman—but on the moon, temperature loses its accustomed meaning, as there is practically no air to imprison you in a stifling blanket of heat, nor to drain the body's warmth with polar gales.

A VOYAGER disembarking upon the near side of the moon, and looking upward whence he came, will see a perpetually black, star-studded sky. The glowing earth—four times as wide as the moon looks to us—always hangs overhead, swaying only a little to and fro. And the sun, a blazing beacon, journeys so leisurely across the heavens that a day is about 29 times as long as on earth.

In the sun's glaring rays, the lunar landscape will look as unreal as stage scenery under klieg lights—dazzling highlights, black shadows. Explorers will need their courage to explore craters that reach 183-mile width and 29,000-foot depth.

Rising like an island from the flat lava floor of the Ocean of Storms, majestic Copernicus, "Monarch of the Moon," measures 56 miles from crest to crest. Its ridged and gullied outer slope is a gentle one, and can be climbed with little exertion, since a 150-pound man weighs only about 25 pounds on the moon. From its crest some future Daniel Boone may look down 17,000 feet, past masses of tumbled rock, into an inner amphitheater as large as Rhode Island.

But when an explorer reaches the bottom center of a crater floor, the outer walls may seem to have shrunk or even vanished completely! Why? Because the moon's curvature, much sharper than the earth's, will sink most or all of the towering ramparts below his horizon.

Lunar mountains surpass anything on earth in wild grandeur. For lack of any sea level with which to compare their altitude, it must be compared with nearby terrain. Loftiest of all by this standard, the Leibnitz Mountains near the south pole soar 35,000 feet, more than a mile higher than Mt. Everest.

Strange and varied formations await sightseers: "clefts" or gaping cracks in the ground, surface swellings called "domes," and unexplained whitish "rays" extending from some craters—perhaps streaks of volcanic ash from the last explosions of dying volcanoes. Impressive indeed will be the Straight Wall in the Sea of Clouds—a sheer 800-foot cliff, 60 miles long. Its nearly vertical face remains blistering-hot after the ground has cooled: It gets the setting sun's rays head-on.

Vividly the scenes will contrast with earthly landscapes—for these gaping craters, these jagged mountains, have been untouched by wind, rain or frost.

These ancient scenes will look ghostly because nature has painted them in monotone—shades of ash-gray and black shadow. But picture-takers bent on shooting color film may discover some exceptions. Most noteworthy is a short-lived ruddy glow, first seen in the 1830's near the little crater Lichtenberg. Once, in 1951, it lasted half an hour. Undoubtedly it's seen, the guidebook's author holds, when the sun's rays fall at a certain angle on "some unusual surface deposit"—another first-class mystery for future lunar explorers to investigate. END

"What We Know About the Moon—So Far" is adapted from an article by Alden P. Armagnac (PS, Nov. '53) and is based on the book A Guide to the Moon *by Patrick Moore (W. W. Norton & Co., New York 3).*

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In just 12 months more than one million people bought new cars of The *Forward* Look. And nearly *half a million* switched to them from other makes of car. Their reasons? They're finding more that's new . . . more that's right . . . than they find anywhere else.

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